THE
Arithmetician's Guide.

In Two PARTS.

PART I.

Containing Practical ARITHMETIC, thro' all its ſeveral Denominations; in EXAMPLES wrought at large, and in a plain and eaſy Manner exhibited, and the Work of FRACTIONS, both *Vulgar* and *Decimal*, compleated.

PART II.

Containing the Principles of ALGEBRA, in a more plain and intelligible a Manner, than any heretofore extant.

Illuſtrated in the Numerical and Literal SOLUTION of many EXAMPLES, both in *Simple* and *Quadratic Equations*. Wherein every Proceſs, both by Figures and Letters, are from Rules, ſo plain, eaſy, and clear, that Perſons of a mean Underſtanding may comprehend them.

By *THO. CROSBY*,

Teacher of the MATHEMATICS, upon *Horſely-Down*, in SOUTHWARK.

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The Revd Mr Anderson;

Hannah Drew and

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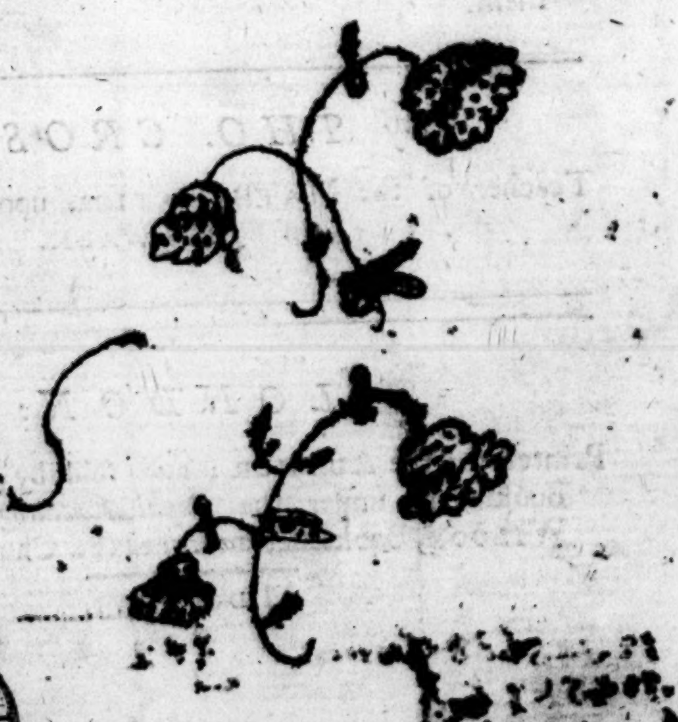

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a All

All which I have endeavoured to deliver in as plain and eafy a Manner as I could, and in the fame Manner as I have taught the fame above 40 Years; and doubt not, but it will be very acceptable to thofe who have been my *Scholars*; and do hope, it will be alfo acceptable to others, who are defirous to become good and expert Book-keepers.

I do not propofe this *Treatife* by Way of *Subfcription*, as my former; but fhall hold myfelf very much obliged to thofe who are willing to become *Purchafers*, if they will let me know it, that I may regulate the *Number* of the *Impreffion*, and deliver the fame to them as foon as it fhall be printed off.

N.B. The AUTHOR ftill continues to board *Young Gentlemen*, and teach them, both at Home and Abroad,

ARITHMETIC, in all its Parts.

ALGEBRA, both *Numerically* and *Literally*.

GEOMETRY, applied to *Meafuring*, *Surveying*, and *Gauging*.

TRIGONOMETRY, applied to *Navigation*, *Geography*, and *Aftronomy*.

THE USE of *Globes*, *Charts*, and other *Mathematical* Inftruments.

THE ITALIAN Method of *Book-keeping*, called *Merchants Accompts*, with the other Methods of *Book-keeping*, as practifed by *Merchants*, *Shopkeepers*, and others.

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To my Worthy FRIENDS,

The SUBSCRIBERS

To this ESSAY.

Gentlemen,

MY Ambition to have your *Names* ſtanding in the Front of my *Book*, was to induce the *World* to be, at leaſt, civil to it.

I could indeed have dedicated theſe *Sheets* to ſome Men of a HIGH TITLE; but I choſe rather to addreſs them to you, as it was your Encouragement made me venture upon the Publication of them.

Subſcribers to a Book are *Patrons* indeed, when Men of a HIGH TITLE are but nominally ſo; and generally make but ſmall Reckoning of ſuch Preſents made to them.

 I know,

DEDICATION.

I know, that many of you have advanced ſo far in this *Art* and *Science*, that the *Book* cannot contribute to further your Progreſs therein; and therefore your ready Encouragement to promote its Publication, is an Evidence of the Reſpect you bear to me, the *Author* of it; which makes me haſte, without any further *Apology*, gratefully to acknowledge the Favour, by dedicating the ſame to you, and ſubſcribing myſelf,

GENTLEMEN,

Your moſt Obliged,

Moſt Obedient, and

Very Humble Servant,

Horſely-down, in
SOUTHWARK,
Sept. 20, 1746.

THO. CROSBY.

THE

PREFACE.

IT *must be granted, that* Arithmetic *and* Geometry, *are the Foundations of all useful Sciences.* Plato *therefore very justly called them the two Wings whereby the Minds of Men might mount up to Heaven, that is, in searching after the Motions and Properties of the Celestial Bodies.*

It were to be wished, that these Sciences *only were taught in all our* Writing-Schools, *and the learned Gentlemen in the Languages left wholly to their own Province: For the learning of* Grammar, *blended with* Writing *and* Accompts, *too much practised in our common Schools, apparently spoils both; and the Generality of Youth, after* six *or* seven *Years Exercise in this Manner, turn out with Qualifications hardly fit for the meanest Employments.*

To

The PREFACE.

To instruct Youth has been my Practice above Forty Years. Besides the Principles of Arithmetic *and* Algebra, *with the modern Methods of* Book-keeping, *suited to* Tradesmen *and* Merchants, *many have attained the Principles of* Geometry, *and applied the same to* Measuring, Surveying, *and* Gauging, *and have been initiated into the Principles of* Geography *and* Astronomy, *before they have arrived at Age to be placed out Apprentice.*

This Treatise *sets forth the Method only I have used, in the Principles of* Arithmetic *and* Algebra. *In which is first exhibited, the general Rules of* Numeration, Addition, Subtraction, Multiplication, *and* Division, *in whole Numbers; and the same applied to* Money, Weights, *and* Measure.

Then follows an easy, plain, and practical Method, to determine the Amount of any Quantity at any Price, *by one general Rule; and some easy and very plain Rules to account for* Commissions, Brokage, purchasing of public Stocks, *the* Interest of Money, *and* Exchanges.

In the next Place you have another Method, by one general Rule, to determine the Amount of any Quantity at any Price, *which, in the Language of* Arithmeticians, *is generally stiled* Practice.

Practice. *Then I proceed to ſhew the Uſe of* Fractions, *both* Vulgar *and* Decimal; *and becauſe the Work of* Decimals *is the moſt uſeful, and differs not from whole Numbers, but in ſeparating the* Decimals *from the* Integers, *I begin with* Decimal Arithmetic, *and apply the ſame to the Computation of the Duties payable at the* Cuſtom-Houſe, *on Importation and Exportation of Goods, and in extracting the* Square *and* Cube *Roots. Then follows* Vulgar Fractions, *in which all the Examples are likewiſe wrought* decimally, *to lead the Learner into a right Underſtanding of this excellent Rule of* Decimal Arithmetic.

I conclude with ſome Examples in the various Rules of Arithmetic, *generally ſtiled the* Rule of Three, Direct, Inverſe, Double Rule, Fellowſhip, Intereſt, *&c. all which I comprehend under the Title of the* Golden Rule. *And here, to perfect the Knowledge and Uſe of* Decimals, *every Example is wrought alſo* decimally, *and compleats the firſt Part of this* Treatiſe.

The ſecond Part begins with Addition, Subtraction, Multiplication, *and* Diviſion *of* Algebraic Quantities. *Then follows the Rule of* Proportion, *the* Reduction of Equations, *and the Solution of many Examples, in* Simple Equations;

Equations; *the* Extraction *of* Roots *by an* Algebraic *Theorem, with* Arithmetical *and* Geometrical *Progression. The* Interest of Money, *the* Computation of Annuities, *or* Pensions *in Arrear, and the present Worth of them. And concludes with the Solution of many Examples in* Quadratic Equations.

All which I have endeavoured to deliver in Rules so clear, plain, and easy, that he that runs may read, without confounding his Judgment, but really informing it: And therefore I commit it to the candid Reader, *and in particular to those who have been under my Instructions.*

J Harrison

1807

for the year — 0 " 6 " 3½

THE

THE *Arithmetician's Guide.*

ARITHMETIC

IS an Art of Accompting by *Numbers*, and doth consist of 5 general Parts, *viz. Numeration*, *Addition*, *Subtraction*, *Multiplication*, and *Division*.

NUMERATION

TEACHETH to read, express, or write down any *Sum* or *Number*, propounded, known, or named, and doth consist of 2 Parts, *viz.*

1. The due Order of placing down *Figures*.
2. The true valuing of each *Figure* in its Place.

Hundreds of Thousands.	Tens of Thousands.	Thousands.	Hundreds.	Tens.	Units.
1	2	3	4	5	6

By this *Table* it is plain, That the *Figure* standing in the Place of *Units*, doth signify so many *Units* as

the *Figure* represents: And the *Figure* in the Place of *Tens*, so many *Tens:* And the *Figure* in the Place of *Hundreds*, so many *Hundreds*, &c. That is, 6 *Units*, 5 *Tens*, (or fifty) 4 *Hundreds*, 3 *Thousands*, 2 *Tens* of *Thousands*, (or twenty Thousand) 1 *Hundred Thousand*. The whole to be read or expressed together, thus; *viz.*

One Hundred Twenty-three Thousand, Four Hundred Fifty-six.

Note. In reading *Numbers*, you must always begin with the *first Figure* towards the Left Hand, and so many *Figures* as are placed together in a Line, without any Point or Note of Distinction between them, are all but *one Sum*; and must be read as such: As in the *Examples* following.

Example 1 - - - - - - - - - - 759423
2 - - - - - - - - - - - - 86427
3 - - - - - - - - - - - - - 9503
4 - - - - - - - - - - - - - - 270
5 - - - - - - - - - - - - - - - 94
6 - - - - - - - - - - - - - - - - 8

The first *Example* is read thus, *Seven Hundred Fifty-nine Thousand, Four Hundred Twenty-three.*

The second *Example* thus, *Eighty-six Thousand, Four Hundred Twenty-seven.*

The third thus, *Nine Thousand, Five Hundred and Three.*

The fourth thus, *Two Hundred and Seventy.*

The fifth thus, *Ninety-four.*

The sixth thus, *Eight.*

But if the *Sum* consist of more than 6 *Figures*, place a Period, or Comma, over the *sixth Figure*, (counting from the Right Hand towards the Left) and the other *Figures*, to the Number of *six*, will be so many *Millions*; as in the following *Examples*.

Example

Example 1 - - - - 297671485321

2 - - - - - - 27192537129

3 - - - - - - 5072860724

4 - - - - - - - 570200683

5 - - - - - - - - 97124654

6 - - - - - - - - - 8307291

In the firſt *Example*, the *Sum* to the Period, over the *ſixth Figure*, is read (according to the Table) thus, *Two Hundred Ninety-ſeven Thouſand, Six Hundred Seventy-one*; which is ſo many *Millions*: So that the whole *Example* muſt be thus read, *Two Hundred Ninety-ſeven Thouſand, Six Hundred Seventy-one Million, Four Hundred Eighty-five Thouſand, Three Hundred Twenty-one.*

The ſecond *Example* is read thus, *Twenty-ſeven Thouſand, One Hundred Ninety-two Million, Five Hundred Thirty-ſeven Thouſand, One Hundred Twenty-nine.*

The *Third* thus, *Five Thouſand Seventy-two Million, Eight Hundred Sixty Thouſand, Seven Hundred Twenty-four.*

The *Fourth* thus, *Five Hundred Seventy Million, Two Hundred Thouſand, Six Hundred Eighty-three.*

The *Fifth* thus, *Ninety-ſeven Million, One Hundred Twenty-four Thouſand, Six Hundred Fifty-four.*

The *Sixth* thus, *Eight Million, Three Hundred Seven Thouſand, Two Hundred Ninety-one.*

But if the *Sum* ſhould be ſtill farther increaſed, then by placing a Comma, or Period, over every *ſixth Figure*, it may eaſily read, only obſerving; That from the *firſt* Period to the *ſecond*, the *Sum* is ſo many *Millions*, from the *ſecond* to the *third*, ſo many *Billions*, from the *third* to the *fourth*, ſo

many *Trillions*, &c. to the End of the annexed TABLE.

Millions Billions Trillions Quadrillions Quintillions Sextillions Septillions Octillions Nonillions	Let the following *Example* be considered, which I think will be sufficient to the understanding of the whole, *viz.* 1712346719402719467192312 To be read thus, *viz.*

One Quadrillion, Seven Hundred Twelve Thousand, Three Hundred Forty-six Trillion, Seven Hundred, Nineteen Thousand, Four Hundred Two Billion, Seven Hundred Nineteen Thousand, Four Hundred Sixty-seven Million, One Hundred Ninety-two Thousand, Three Hundred Twelve.

From whence it may be observed, That if the young Learner be first taught to read a *Sum*, to the Number of *six Figures*, how easily afterwards he may read any greater *Sum*.

ADDITION

IS the gathering, or collecting of *many Numbers* into *one Sum*, called the *Total*; and doth consist of *three* Varieties, *viz. Money*, *Weight*, and *Measure*: To which may be added *Time*: Which have *Tables* of the several denominative Parts belonging thereto, from the least to the greatest Denomination.

To add *Integers* together, you must carefully observe, to place *Units* under *Units*, *Tens* under *Tens*,

Tens, *Hundreds* under *Hundreds*, &c. and then proceed according to the following Rule.

RULE.

First, add together all the *Figures*, that stand in the Place of *Units*; and if their Sum be under *Ten*, set it down below the Line under its own Place: But if their Sum be *Ten*, or above *Ten*, it consists of 2 Figures, one whereof, *viz.* the *Units*, must be set down, and the other, *viz.* the *Tens*, must be carried to the next Row of Figures, &c. as in the following Examples.

Exa. 1.	Exa. 2.	Exa. 3.
246719	3126719	42671982
327194	4213716	21467194
671283	9212744	32671942
421537	5267392	22467297
443126	7146837	53716729
571928	4159326	31246719
2681787	33126734	204241863
2435068	30000015	161569881
2681787	33126734	204241863

In the *first* Example, beginning at the Place of *Units*, I say, 8 and 6 is 14, and 7 is 21, and 3 is 24, and 4 is 28, and 9 is 37, *I set down* the 7 *Units*, and *carry* the 3 to the next Row of Figures, saying, 3 and 2 is 5, and 2 is 7, and 3 is 10, and 8 is 18, and 9 is 27, and 1 is 28, *I set down* 8, and *carry* 2 to the next Place, saying, 2 and 9 is 11, and 1 is 12, and 5 is 17, and 2 is 19, and 1 is 20, and 7 is 27, *I set down* 7, and *carry* 2 to the next Place, saying, 2 and 1 is 3, and 3 is 6, and 1 is 7, and 1 is 8, and 7 is 15, and 6 is 21, *I set down* 1, and *carry* 2 to the next Place, saying,

ſaying, 2 and 7 is 9, and 4 is 13, and 2 is 15, and 7 is 22, and 2 is 24, and 4 is 28, *I ſet down* 8, and *carry* 2 to the next Place, ſaying, 2 and 5 is 7, and 4 is 11, and 4 is 15, and 6 is 21, and 3 is 24, and 2 is 26. This being the laſt Row of *Figures*, I ſet down the whole Number 26, as in the *Example*.

The ſecond and third *Examples*, are done after the ſame Manner.

The common Method of proving the Work of *Addition*, is, by ſeparating the *firſt* Line from the Work, and *adding* together the *Reſidue*. Then to the *ſeparated* Line *add* the *Total* of the *Reſidue*, it gives the *whole Sum*: The Reaſon of which is plain, from that natural Truth, of the *whole* being *equal* to all the Parts taken together.

The *Proof* of the firſt *Example*.

The ſeparated Line is	246719
The Total of the Reſidue .	2435068
	2681787

Note. It may be ſufficient in *Practice*, to prove *Addition*, by beginning at the Top, and *adding* together, the ſame Numbers downwards.

SUBTRACTION

IS the taking of a *leſs* Number, from a *greater*, that ſo the *Remainder*, *Difference*, or *Exceſs*, may be known.

To *ſubtract Integers*, obſerve to place *Units* under *Units*, *Tens* under *Tens*, *Hundreds* under *Hundreds*, &c. and the *leſs* Number under the *greater*, and then follow this general Rule.

RULE.

RULE.

First *subtract* the *lower* Figure in the *Units* Place, from the *upper* Figure in the *Units* Place, and set down the *Remainder*; but if the *lower* Figure be greatest, you must call the *upper* Figure *ten* more than it is, and *subtract*; always remembering, that when you have so done, you must *carry one* to the next Figure *below*, and proceed to *subtract* in that Place, as in the former; and so gradually on, from one Row of *Figures* to another, till all be done.

	Exa. 1.	Exa. 2.	Exa. 3.
From	7194672	9467294	8127953
Take	5171231	5371697	6257428
Rem.	2023441	4095597	1870525

In Example the *first*, I begin with the *lower* Figure, in the *Units* Place, saying, 1 from 2, and there *remains* 1, I set down 1, and proceed to the next Place, saying, 3 from 7, and there *remains* 4, I set down 4, and proceed to the next Place, saying, 2 from 6, and there *remains* 4, I set down 4, and proceed to the next, saying, 1 from 4, and there *remains* 3, I set down 3, and proceed to the next, saying, 7 from 9, and there *remains* 2, and so on; 1 from 1, and there *remains* 0, 5 from 7, and there *remains* 2, and set down the Figures, 2,0,2,3,4,4,1, in their Places, as in the Example.

In Example the *second*, I begin as afore, saying, 7 from 4 I cannot, (calling it 10 more) but 7 from 14, and there *remains* 7, I set down 7, and proceed to the next Place, (carrying 1) saying, 1 and 9 is 10, from 9 I cannot, but 10 from 19, and there *remains* 9, I set down 9, and proceed to the next Place, (carrying 1) saying, 1 and 6 is 7, from 2 I cannot, but 7 from 12, and there *remains* 5, I set down 5, and proceed to the next Place, (carrying

ing 1) ſaying, 1 and 1 is 2, from 7, and there *remains* 5, (here I carry nothing, becauſe I did not call 7, 17) having ſet down 5, I proceed, ſaying, 7 from 6 I cannot, but 7 from 16, and there *remains* 9, I ſet down 9, and proceed to the next Place, (carrying 1) ſaying, 1 and 3 is 4, from 4, and there *remains* 0, I ſet it down, and proceed, ſaying, 5 from 9, and there *remains* 4, which being ſet down, I have done.

The third *Example*, is wrought after the ſame Manner.

If you *add* the *Remainder* to the *under* Line (which is called the *Subtrahend)* it will produce the *upper* Line, and is the *Proof* of your Work.

MULTIPLICATION

IS a compendious Way of *Addition*, conſiſting of 3 Parts, *viz.* *Multiplicand*, *Multiplier*, and *Product*.

The *Multiplicand*, is the Sum or Number given to be multiplied.

The *Multiplier*, is the Sum or Number given, by which the *Multiplicand* is to be multiplied, and denotes the Number of Times, that the *Multiplicand* is to be added to itſelf.

The *Product*, is the Sum or Number produced, by the *Multiplicands*, being multiplied, into or with the *Multiplier*.

Before any Operation can be readily performed in Multiplication, the following *Table* muſt be perfectly learned.

TABLE

TABLE.

2 Times	5 Times	11 Times	12 Times
2 - is - 4	5 - is - 25	2 - - is - - 22	2 - - is - - 24
3 — — 6	6 — — 30	3 — — 33	3 — — 36
4 — — 8	7 — — 35	4 — — 44	4 — — 48
5 — — 10	8 — — 40	5 — — 55	5 — — 60
6 — — 12	9 — — 45	6 — — 66	6 — — 72
7 — — 14		7 — — 77	7 — — 84
8 — — 16	6 Times	8 — — 88	8 — — 96
9 — — 18	6 - is - 36	9 — — 99	9 —— 108
	7 — — 42	10 —— 110	10 —— 120
3 Times	8 — — 48	11 —— 121	11 —— 132
3 - is - 9	9 — — 54	12 —— 132	12 —— 144
4 — — 12			
5 — — 15	7 Times		
6 — — 18	7 - is - 49		
7 — — 21	8 — — 56		
8 — — 24	9 — — 63		
9 — — 27			
	8 Times		
4 Times	8 - is - 64		
4 - is - 16	9 — — 72		
5 — — 20			
6 — — 24	9 Times		
7 — — 28	9 - is - 81		
8 — — 32			
9 — — 36			

Note. 3 Times 2, is the same with 2 Times 3; and 4 Times 2, the same with 2 Times 4; and 5 Times 2, the same with 2 Times 5, &c.

The like is to be understood, of all the rest in the TABLE.

Having perfectly learnt the aforegoing *Table*, the Work of *Multiplication* will be very easy, if the following *Examples* be carefully observed.

	Exa. 1.	Exa. 2.
Multiplicand	3719467	5714936
Multiplier	2	30
Product	7438934	171448080

Exa. 3.	Exa. 4.	Exa. 5.
5712943	527194	137194671
4	700	12
22851772	369035800	1646336052

In the firſt *Example*, I begin with the *Units* Place, in the *Multiplicand*, (and ſo muſt always) ſaying, 2 Times 7 is 14, *I ſet down* 4, and *carry* 1 to the next Place, ſaying, 2 Times 6 is 12, and 1 is 13, *I ſet down* 3, and *carry* 1 to the next Place, ſaying, 2 Times 4 is 8, and 1 is 9, *I ſet down* 9, and have nothing to carry. Therefore I go on, ſaying, 2 Times 9 is 18, *I ſet down* 8, and *carry* 1, ſaying, 2 Times 1 is 2, and 1 is 3, *I ſet down* 3, and proceed, ſaying, 2 Times 7 is 14, *I ſet down* 4, and *carry* 1, ſaying, 2 Times 3 is 6, and 1 is 7, which being ſet down, compleats the Work, as in the *Example*.

In the ſecond *Example*, where the *Multiplier* is 30, I proceed as afore, ſetting the *Cypher* one Place forward: And in the fourth *Example*, where the *Multiplier* is 700, ſetting the *Cyphers* 2 Places forward, as appears by the *Examples*.

In the fifth *Example*, beginning at the *Units* Place, I ſay, 12 Times 1 is 12, *I ſet down* 2, and *carry* 1 to the next Place, ſaying, 12 Times 7 is 84, and 1 that *I carry* is 85, *I ſet down* 5, and *carry* 8, ſaying, 12 Times 6 is 72, and 8 that *I carry* is 80, *I ſet down* 0, and *carry* 8, ſaying, 12 Times 4 is 48, and 8 is 56, *I ſet down* 6, and *carry* 5, ſaying, 12 Times 9 is 108, and 5 is 113, *I ſet down* 3, and *carry* 11, ſaying, 12 Times 1 is 12, and 11 is 23, *I ſet down* 3, and *carry* 2, ſaying, 12 Times 7 is 84, and 2 is 86, *I ſet down* 6, and *carry* 8, ſaying, 12 Times 3 is 36, and 8 is 44, *I ſet down* 4, and *carry* 4, ſaying, 12 Times 1 is 12, and 4 is 16, which being ſet down, compleats the *Operation*, as in the Example.

The Work of theſe *two* Examples, I preſume, is ſufficient to ſhew the young Learner, all the reſt: Obſerving, that when a *Cypher* or *Cyphers* is annexed to the End of the Multiplier, that they be ſet

ſet forward, and taken down in the Product, as in the 2d and 4th *Example*, as afore hinted.

But when the *Multiplier* doth conſiſt of more than one Figure; then ſo many Figures as there are in the *Multiplier*, ſo many particular Products there muſt be, and the *Sum* of all thoſe Products, will be the true Product required.

Note. The *firſt* Figure or *Cypher* of every *Product*, muſt be placed directly underneath the *multiplying* Figure, as in the following Examples.

57192343	49271946	42719467
13	69	908
171577029	443447514	341755736
57192343	295631676	3844752030
743500459	3399764274	38789276036

(6)	(7)
57194672	567213719
422	57008
114389344	4537709752
114389344	397049603300
228778688	2836068595
24136151584	32335719692752

(8)	(9)
57294671	7129467
4592	39804
114589342	28517868
515652039	570357360
286473355	64165203
229178684	21388401
263097129232	283781304468

(10)	(11)
3827194	5719400
5268	54007020
30617552	114388000
22963164	400358000
7654388	2287760000
19135970	28597000
20161657992	308887750188000

These *Examples* are ſufficient to inſtruct the Learner, in all the Varieties that can happen in *multiplying* of whole Numbers: And here I might ſhew the Method of performing *Multiplication* by *Addition* only; but becauſe that Method is not preferable to this, I ſhall therefore omit inſerting of it.

The common Method of *proving* Multiplication, by caſting away the *Nines* in the Multiplicand, Multiplier, and Product, being not infallible, I ſhall omit it, and here only acquaint you, that the beſt Way of *proving* Multiplication, is by dividing the *Product*, by the *Multiplicand*, or *Multiplier*; the *Quotient* without any *Remainder*, ſhews the *Multiplier*, or *Multiplicand*, as will plainly appear at the Cloſe of *Diviſion*, to which I proceed.

DIVISION

IS a compendious Way of *Subtraction*, conſiſting of 3 Parts, *viz. Dividend*, *Diviſor*, and *Quotient*.

The *Dividend*, is the Sum or Number given, to be divided.

The *Diviſor*, is the Sum or Number given, by which the *Dividend* is to be divided, and denotes the

the Number of Parts, that the *Dividend* is to be divided into.

The *Quotient*, is the Number produced by the *Dividend*, and *Divisor*, and shews how often the *Divisor* is subtracted from, or contained in the *Dividend*, or into what Number of equal Parts the *Dividend* is divided.

All the Difficulty in *Division*, lieth in making Choice of the *Quotient* Figure, so that it be neither too much, nor too little, which will soon be overcome, if you carefully observe the following *Examples*.

	(1)	(2)
	Dividend.	
Divisor	2)47926712	3)59467291
Quotient	23963356	19822430 : 1 Rem.

(3)	(4)
4)372946729	5)3872946719
93236682 : 1	774589343 : 4

(5)	(6)
9)42836714291	12)2489367201
4759634921 : 2	207447266 : 9

In the *first Example*, I first see how many Times 2 the *Divisor*, is contained in 4, the *first* Figure of the *Dividend*, which is 2 Times, I place 2 in the *Quotient*, and proceed, enquiring how many Times 2 is contained in 7, the next Figure, which is 3 Times, for 3 Times 2 is 6, from 7, and there remains 1, *place* 3 in the *Quotient*, and carry the Remainder 1, to the next Figure 9, and see how often 2 is contained in 19, which is 9 Times, and 1 remains, for 9 Times 2 is 18, from 19, and there remains 1, *place* 9 in the *Quotient*, and carry the *remainder*

remainder 1, to the next Figure 2, then ſee how often 2 is contained in 12, which is juſt 6 Times, without any Remainder, *place* 6 in the *Quotient*, and ſee how often 2 is contained in the next Figure 6, which is juſt 3 Times, without any Remainder, *place* 3 in the *Quotient*, and ſee how often 2 is contained in the next Figure 7, which is 3 Times, and 1 remains, *place* 3 in the *Quotient*, and carry the *remainder* 1, to the next Figure 1, and ſee how often 2 is contained in 11, which is 5 Times, and 1 remains, *place* 5 in the *Quotient*, and carry the remainder 1 to the next Figure 2, and ſee how often 2 is contained in 12, which is juſt 6 Times, without any remainder, *place* 6 in the *Quotient*, and the Work is done.

In *Example* 2, I begin and proceed as aforegoing; but in *Examples* 3d, 4th, and 5th, I begin as is ſhewed in Example 5th.

Example 5th. The *firſt* Figure of the *Dividend*, being leſs than the *Diviſor*, begin with the two firſt, *viz.* 42, and ſee how often 9 the *Diviſor*, is contained in them, which is 4 Times, for 4 Times 9 is 36, from 42, and there remains 6, *place* 4 in the *Quotient*, *carrying* 6 to the next Figure 8, it makes 68, then ſee how often 9 is contained in 68, which is 7 Times, and 5 remains, *place* 7 in the *Quotient*, and *carry* 5 to the next Figure 3, ſee how often 9 is contained in 53, which is 5 Times, and 8 remaining, *place* 5 in the *Quotient*, and *carry* 8 to the next Figure 6, and ſee how often 9 is contained in 86, which is 9 Times, and 5 remaining, *place* 9 in the *Quotient*, and *carry* 5 to the next Figure 7, ſee how often 9 is contained in 57, which is 6 Times, and 3 remaining, *place* 6 in the *Quotient*, and *carry* 3 to the next Figure 1, ſee how often 9 is contained in 31, which is 3 Times, and 4 remaining, *place* 3 in the *Quotient*, and *carry* 4 to the next Figure 4, ſee how often 9 is contained in

44,

44, which is 4 Times, and 8 remaining, *place* 4 in the *Quotient*, and *carry* 8 to the next Figure 2, ſee how often 9 is contained in 82, which is 9 Times, and 1 remaining, *place* 9 in the *Quotient*, and *carry* 1 to the next Figure 9, ſee how often 9 is contained in 19, which is 2 Times, and 1 remaining, *place* 2 in the *Quotient*, and *carry* 1 to the next Figure 1, and ſee how often 9 is contained in 11, which is 1 Time, and 2 remaining, *place* 1 in the *Quotient*, and ſet down the remainder 2, ſeparated by a *Semicolon*, or other Note of Diſtinction, from the *Quotient*, as in the *Example*, and your Work is done.

Underſtand the like of all the reſt, and all other *Examples*, that may occur with one ſingle Figure for a *Diviſor*.

There are ſeveral Methods taught, and treated of, by Maſters of *Arithmetic*, for the Operation of *Diviſion*, when the *Diviſor* conſiſts of two or more Figures, but the moſt plain and eaſy to be underſtood, is the following Method.

```
      (7)              (8)              (9)
     61128            17307             8432
   -------          -------           ------
13)794672        27)467295        34)286719
   78               27               272
   --               --               ---
    14              197               147
    13              189               136
    --              ---               ---
     16               82               111
     13               81               102
     --               --               ---
      37              195               99
      26              189               68
      --              ---               --
      112               6               31
      104
      ---
        8
```

(10)

```
         14807
572)8469728
    572
    ----
    2749
    2288
    ----
     4617
     4576
     ----
      4128
      4004
      ----
       124
```

(11)

```
         37345
876)32714972
    2628
    ----
     6434
     6132
     ----
      3029
      2628
      ----
       4017
       3504
       ----
        5132
        4380
        ----
         752
```

(12)

```
           74808
4972)371946719
     34804
     -----
      23906
      19888
      -----
       40187
       39776
       -----
        41119
        39776
        -----
         1343
```

(13)

```
              4597
92837)426837194
      371348
      ------
       554891
       464185
       ------
        907069
        835533
        ------
         715364
         649859
         ------
          65507
```

(14)

```
              8327196
       ------------------
647082)5388378642072
       5176656
       -------
        2117226
        1941246
        -------
         1759804
         1294164
         -------
          4656402
          4529574
          -------
           1268280
            647082
           -------
            6211987
            5823738
            -------
             3882492
             3882492
             -------
                   0
```

Example 7, I observe how often 1 (the *first* Figure of the *Divisor*) is contained in 7, (the *first* Figure of the *Dividend*) which is 7 Times; but 7 Times 13 is 91, which exceeds 79 (the two first Figures of the *Dividend*) therefore I take 1 less than 7 (*viz.* 6) and place it in the *Quotient*; then multiply the *Divisor* 13, by the *Quotient* Figure 6, it makes 78, drawing a Line underneath; I *subtract*, and the *Remainder* is 1, to which I bring down the next Figure of the *Dividend*, (viz. 4) and so have 14 for a new *Dividend*, as you see in the *Example*. Then I see again, how often 1, the *first* Figure of the *Divisor*, is contained in 1, the *first* Figure of the new *Dividend*, which is 1 Time, and place it in the *Quotient*, by which I again multiply

the *Divisor*, it makes 13, and *subtract* as afore, the Remainder is again 1, to which I bring down the next Figure 6, which makes 16, for a new *Dividend*; now again, I see how often 1 is contained in 1, and is 1 Time, which placed in the *Quotient*, I therewith multiply the *Divisor*, it makes 13, which being *subtracted* from the last new *Dividend*, leaves 3, to which I bring down the next Figure 7, and see how often 1 is contained in 3, which for my purpose is but 2 Times, by which I multiply the *Divisor*, it makes 26, and *subtract*, the *Remainder* is 11, to which I bring down the next Figure 2, and it makes 112; I see how often 1 is contained in 11, which for my Purpose is 8 Times, wherewith I multiply the *Divisor*, it makes 104, and *subtract*, the Remainder is 8, and having no more Figures to bring down, this *Example* is finished.

Example 11th. The *first* Figure of the *Divisor*, being greater than the *first* Figure of the *Dividend*, I see how often 8 is contained in 32, which is just 4 Times, and is too much for my Purpose; for the Product of the *Divisor* multiplied by 4, will be greater than 3271, therefore I set down but 3 in the *Quotient*, and multiply the *Divisor* therewith, it produces 2628, which *subtracted* from 3271, leaves 643, to which I bring down the next Figure 4, and have 6434, for a new *Dividend*; then I see how often 8 is contained in 64, which for my Purpose is 7 Times, wherewith I multiply the *Divisor*, it produces 3504, which *subtracted* from 6434, leaves 302, to which I bring down the next Figure 9, and see how often 8 is contained in 30, which is 3 Times, wherewith I multiply the *Divisor*, and it produces 2628, which being *subtracted* from 3029, leaves 401; to which I bring down the next Figure 7, and see how often 8 is contained in 40, which for my Purpose is 4 Times, wherewith I multiply the *Divisor*, it produces 3504, which being

ing *subtracted* from 4017, leaves 513, to which I bring down the next Figure 2, and see how often 8 is contained in 51, which is 5 Times, wherewith I multiply the *Divisor*, it produces 4380, which being *subtracted* from 5132, leaves 752, and so the Operation is finished.

Example 12. Having in the preceeding Method, carried on the Operation, I find when 1 is brought down to the Remainder 411, that the new *Dividend*, viz. 4111, is less than the *Divisor*, therefore I place 0 in the *Quotient*, and must always do so, in the like Case, and bring down the next Figure 9, and then proceed as in the *Example*.

Note. If the *Remainder* after *Subtraction*, before the next Figure is brought down to it, be greater than the *Divisor*, your last *Quotient* Figure, is too little, and must be increased.

Also if the *Product* of the *Divisor*, by the *Quotient* Figure, be greater than the *Dividend*, from which it is to be subtracted, then is your last *Quotient* Figure too great, and must be decreased.

For the *Proof* of *Division*, If the *Quotient*, and *Divisor*, be multiplied together, and the *Remainder*, if any, be added to it, it will produce the *Dividend*.

Exa. 14.

Quotient	8327196
Divisor	647082
	16654392
	66617568
	58290372
	33308784
	49963176
	5388378642072

Exa. 13.

Divisor	92837
Quotient	4597
	649859
	835533
	464185
	371348
	426771689
Rem.	65505
	426837194

 Thus

Thus having plainly and briefly gone through the 5 general Parts of *Arithmetic*, viz. *Numeration*, *Addition*, *Subtraction*, *Multiplication*, and *Division*; being the *Foundation*, upon which all *Operations* whatsoever, that are possible to be wrought by Numbers are built, I shall therefore here advise the Learner, to be well acquainted with what hath been delivered, before he proceed.

I shall pass by all the other Ways of *Division*, by cancelling the Figures, as we proceed in the Work, because in Practice, those Methods are best, that are plainest, and least liable to Mistakes; I would therefore advise the *Practitioner*, to commit as little to his Head as possible; and follow the Practice of *Division*, as I have here exhibited it; and proceed to the Application of these general Rules, in *Money*, *Weights*, and *Measures*.

Of MONEY.

THE least Piece used in *England*, is a *Farthing*, and from thence ariseth the other Denominations, as in the Table following, *viz.*

4	Farthings	make	1 Penny.
12	Pence	- - - - - -	1 Shilling.
20	Shillings	- - - - -	1 Pound.

To add Sums of Money together, due Care must be taken, to place all the Numbers of the same Denomination, exactly underneath each other, *viz.* place *Pounds* under *Pounds*, *Shillings* under *Shillings*, *Pence* under *Pence*, and *Farthings* under *Farthings*.

The like is to be understood in *Weights*, and *Measures*, according to their several Denominations. Then observe this general Rule.

RULE.

RULE.

Begin with the Figures of the *least* Denomination, and add them altogether into one Sum; then consider how many of the next *superior* Denomination, are contained in that Sum, so many *Units* must be carried to the said next *superior* Denomination, and the *Overplus*, if there be any, must be set down underneath its own *Denomination*, and so proceed from one *Denomination* to the other, till all be finished.

(1)		(2)			(3)		
l.	*s.*	*l.*	*s.*	*d.*	*l.*	*s.*	*d.*
2794	13	371	14	10	5672	11	$9\frac{1}{4}$
1724	14	219	15	11	3826	12	8
3716	15	437	16	10	4271	13	$7\frac{1}{2}$
2143	16	526	17	9	5372	14	$6\frac{3}{4}$
9167	17	729	18	8	9137	15	5
4283	18	832	19	7	4672	16	$4\frac{1}{4}$
£.23831	13	£.3119	3	7	£.32954	4	$4\frac{3}{4}$

In the *first Example*, according to the Rule, I begin with the *Shillings*, being there the least *Denomination*; and adding them together, I find the Sum to be 93 Shillings, that is, 4 *Pounds*, 13 *Shillings*, I set down 13 *Shillings*, and carry 4 *Pounds* to the Place of *Pounds*, saying, 4 and 3 is 7, and 7 is 14, and so on, as in *Addition* of Integers, till the Work is finished, as in the Example.

In the 2d *Example*, I begin with the *Pence*, and find their Sum to be 55, that is, 4 *Shillings* and 7 *Pence*, because 12 Times 4 is 48, and 7 is 55, I set down the 7 *Pence*, and carry the 4 *Shillings* to the Place of *Shillings*, adding them, and all the *Shillings* together, I find the Sum of 103 *Shillings*, that is, 5 *Pounds* 3 *Shillings*, I set down 3 *Shillings*, and carry 5 *Pounds* to the Place of *Pounds*, and proceed as afore.

In

In the 3d *Example*, I begin with the *Farthings*, and find their Sum to be 7, that is, 1 *Penny* 3 *Farthings*, I set down 3 *Farthings*, and carry 1 *Penny* to the Place of *Pence*, and proceed as aforegoing.

Each *Example* is proved by separating the *first* Line, as in *Addition* of Integers, which I leave to the Practitioner.

To *subtract* Money from Money, observe this general Rule.

RULE.

Begin with the *least* Denomination, and *subtract* the *under* Figure or Figures from the *upper*, of the same *Denomination*, and set down the *Remainder*; but if the *under* Figure or Figures be the greatest, increase the upper, with one of the next *superior* Denomination, and subtract, and so proceed to the next Place, where you must pay the 1 borrowed, by *adding* 1 to the under Figure, or Figures in that Place, *&c.* as in *Subtraction* of Integers.

	(1)			(2)			(3)		
	l.	*s.*	*d.*	*l.*	*s.*	*d.*	*l.*	*s.*	*d.*
Lent	7597	16	8	2468	14	5	3719	18	$10\frac{1}{4}$
Paid	3154	19	7	1975	18	3	2664	19	$11\frac{3}{4}$
Rem.	£. 4442	17	1	£. 492	16	2	£. 1054	18	$10\frac{1}{2}$

In the 3d Example, I begin with the *Farthings*, saying, $\frac{3}{4}$ from $\frac{1}{4}$, I cannot, but 3 from 5, the *upper* increased by 1 *Penny*, and there remains 2, I set down 2, and proceed to the next Place, *viz.* *Pence*, saying, the 1 that I borrowed, and 11 is 12 *Pence*, from 10 *Pence* I cannot, but 12 from 22, the *upper* increased by 1 *Shilling*, and there *remains* 10, I set down 10, and proceed to the *Shillings*, saying, 1 that I borrowed and 19 *Shillings* is 20

Shillings

Shillings from 18 I cannot, but 20 from 38, the *upper* increased by 1 *Pound*, and there *remains* 18, I set down 18, and proceed to the *Pounds*, saying, 1 that I borrowed, and 4 is 5 from 9, and there *remains* 4, and so on, 6 from 1 I cannot, but 6 from 11, and there *remains* 5, 1 that I borrowed and 6 is 7, from 7, and there *remains* 0, 2 from 3, and there *remains* 1, all which being set down, the *Remainder* is 1054 *l.* 18 *s.* 10 *d.* $\frac{1}{2}$ as in the *Example.*

The 2 other *Examples* are wrought in the same Manner.

Note. The Remainder, is by Merchants called the Ballance of an Account, and is that Sum of Money, which makes the Dr. and Cr. Side both equal, as in the Examples following.

(1)

Mr. *A. B.* Dr.	*l.*	*s.*	*d.*	*per Contra,* Cr.	*l.*	*s.*	*d.*
To - - - - -	7597	14	7	By - - - -	322	15	8
				By - - - -	456	16	9
				By - - - -	594	17	6
				By - - - -	322	18	5
				By Ball.	5900	06	3
					7597	14	7

(2)

Mr. *A. B.* Dr.	*l.*	*s.*	*d.*	*per Contra,* Cr.	*l.*	*s.*	*d.*
To - - - - -	326	14	9	By - - - -	1794	15	8
To - - - - -	572	19	8	By Ball.	87	07	10
To - - - - -	654	17	7				
To - - - - -	327	11	6				
	1882	03	6		1882	03	6

(3)

(3)

Mr. *A. B.* Dr.				*per Contra* Cr.			
To - - - -	444	15	9	By - - -	356	11	5
To - - - -	356	14	6	By - - -	271	10	3
To - - - -	272	11	8	By - - -	369	09	2
To - - - -	554	10	2	By Ball.	631	01	3
	1628	12	1		1628	12	1

Note. In the preceeding Examples, the ſeveral Sums, Dr. and Cr. are firſt added together, and then Subtraction is made to find the Ballance, as in Example 1. The ſeveral Sums Cr. added together, is 1697*l.* 8*s.* 4*d.* which ſubtracted from the Dr. 7597*l.* 14*s.* 7*d.* leaves 5900*l.* 6*s.* 3*d.* which is the Ballance of that Account, and makes the Dr. and Cr. ſide equal.

In Example 2. The ſeveral Sums Dr. added together, is 1882*l.* 3*s.* 6*d.* from which the Cr. 1794*l.* 15*s.* 8*d.* is ſubtracted, and leaves 87*l.* 7*s.* 10*d.* the Ballance of that Account.

In Example 3. The ſeveral Sums Dr. added together, is 1628*l.* 12*s.* 1*d.* and the ſeveral Sums Cr. added together, is 997*l.* 10*s.* 10*d.* which ſubtracted from the Dr. 1628*l.* 12*s.* 1*d.* leaves 631*l.* 1*s.* 3*d.* the Ballance of that Account.

The Proof of Subtraction of Money is, by adding the Remainder to the Sum paid, and it will produce the Sum lent.

		l.	*s.*	*d.*
Example 1.	The Sum paid is	3154	19	7
	The Remainder	4442	17	1
		7597	16	8

		l.	*s.*	*d.*
Example 3.	The Sum paid	2664	19	11¼
	The Remainder	1054	18	10½
		3719	18	10¼

To

To *multiply* Money in the Manner here delivered, is one of the moſt uſeful Parts in *Arithmetic*; and has been but lightly touched upon, or not at all, by moſt *Authors*, and *Teachers* of *Arithmetic* that I have ſeen. It is many Years ago, that I publiſhed a Specimen of it, and have indeed ſince, ſeen ſome little Uſe made thereof, both by *Authors*, and *Teachers* of *Arithmetic*, but its intire Uſefulneſs will be evident in the Sequel of this *Treatiſe*. For *Multiplication* is no other, but the *Addition*, or repeating the ſame Thing, a certain Number of Times, and conſequently produces the *Poſition*, or *Affirmation* of the Thing, ſo many Times more than it was before. The following *Examples* I doubt not, will be very plain and eaſy to them, who have well learned the preceeding Parts of this *Treatiſe*.

(1)

	l.	*s.*	*d.*
Multiply	7248	15	9
By - - - - - - - - -			7
Product £.	50741	10	3

(2)

	l.	*s.*	*d.*
Mult.	6275	14	8
By - - - - - - - - -			9
£.	56481	12	0

(3)

	l.	*s.*	*d.*
Multiply	6754	18	$9\frac{1}{4}$
By 19		9	10
£.	67549	7	$8\frac{1}{2}$
	60794	8	$11\frac{1}{4}$
£.	128343	16	$7\frac{3}{4}$

(4)

	l.	*s.*	*d.*
Mult.	3825	18	10
By 17		7	10
£.	38259	8	$6\frac{1}{2}$
	26781	11	$11\frac{3}{4}$
£.	65041	00	$6\frac{1}{4}$

(5)

	l.	*s.*	*d.*
Multiply	8327	18	$10\frac{1}{2}$
By 14		4	10
£.	83279	8	9
	33311	15	6
£.	116591	4	3

(6)

	l.	*s.*	*d.*
Multiply	4529	19	$10\frac{1}{2}$
By 16		6	10
£.	45299	18	9
	27179	19	3
£.	72479	18	0

(7)

	l.	s.	d.
Multiply	3768	18	$9\frac{1}{4}$
By 36		6	10
£.	37689	7	$8\frac{1}{2}$
			3
£.	113068	3	$1\frac{1}{2}$
	22613	12	$7\frac{1}{2}$
£.	135681	15	9

(8)

	l.	s.	d.
Multiply	8275	19	$11\frac{3}{4}$
By 27		7	10
£.	82759	19	$9\frac{1}{2}$
			2
£.	165519	19	7
	57931	19	$10\frac{1}{4}$
£.	223451	19	$5\frac{1}{4}$

(9)

	l.	s.	d.
Mult.	2856	17	$9\frac{1}{4}$
By 47		7	10
£.	28568	17	$8\frac{1}{2}$
			4
£.	114275	10	10
	19998	4	$4\frac{3}{4}$
£.	134273	15	$2\frac{3}{4}$

(10)

	l.	s.	d.
Mult.	8256	17	$9\frac{1}{4}$
By 72		2	10
£.	82568	17	$8\frac{1}{2}$
			7
£.	577982	3	$11\frac{1}{2}$
	16513	15	$6\frac{1}{2}$
£.	594495	19	6

(11)

	l.	s.	d.
Mult.	7528	19	$11\frac{1}{8}$
By 273		3	10
£.	75289	19	$3\frac{2}{8}$
		7	10
£.	752899	12	$8\frac{4}{8}$
			2
£.	1505799	5	5
	527029	14	$10\frac{6}{8}$
	22586	19	$9\frac{3}{8}$
£.	2055416	00	$1\frac{1}{8}$

(12)

	l.	s.	d.
Mult.	6397	17	$9\frac{3}{8}$
By 592		2	10
£.	63978	17	$9\frac{6}{8}$
		9	10
£.	639788	18	$1\frac{4}{8}$
			5
£.	3198944	10	$7\frac{4}{8}$
	575810	00	$3\frac{6}{8}$
	12795	15	$6\frac{6}{8}$
£.	3787550	6	6

Note. In these two last and the two following *Examples*, the *Penny* is divided into 8 Parts, and so

so consequently $\frac{2}{8}$ is *one Farthing*, and $\frac{4}{8}$ is *one Halfpenny*, and $\frac{6}{8}$ is *three Farthings*; the which will be found of great Use in the Computation of *Foreign Exchanges*, and such Commodities where they come so near in the Price, as to $\frac{1}{8}$ Part of a *Penny*.

(13)

	l.	*s.*	*d.*
Mult.	3768	18	$9\frac{5}{8}$
By 374		4	10
£.	37689	8	$0\frac{2}{8}$
		7	10
£.	376894	00	$2\frac{4}{8}$
			3
£.	1130682	00	$7\frac{4}{8}$
	263825	16	$1\frac{6}{8}$
	15075	15	$2\frac{4}{8}$
£.	1409583	11	$11\frac{6}{8}$

(14)

	l.	*s.*	*d.*
Mult.	8249	19	$11\frac{7}{8}$
By 675		5	10
£.	82499	19	$10\frac{6}{8}$
		7	10
£.	824999	18	$11\frac{4}{8}$
			6
£.	4949999	13	9
	577499	19	$3\frac{2}{8}$
	41249	19	$11\frac{3}{8}$
£.	5568749	12	$11\frac{5}{8}$

(15)

	l.	*s.*	*d.*
Mult.	2167	14	$3\frac{1}{2}$
By 2375		5	10
£.	21677	2	11
		7	10
£.	216771	9	2
		3	10
£.	2167714	11	8
			2
£.	4335429	3	4
	650314	7	6
	151740	0	5
	10838	11	$5\frac{1}{2}$
£.	5148322	2	$8\frac{1}{2}$

(16)

	l.	*s.*	*d.*
Mult.	3251	6	$1\frac{1}{4}$
By 4759		9	10
£.	32513	1	$0\frac{1}{2}$
		5	10
£.	325130	10	5
		7	10
£.	3251305	4	2
			4
£.	13005220	16	8
	2275913	12	11
	162565	5	$2\frac{1}{2}$
	29261	14	$11\frac{1}{4}$
£.	15472961	9	$8\frac{3}{4}$

(17)

	l.	s.	d.
Mult.	5243	2	3¾
By 5356		6	10
	£. 52431	3	1½
		5	10
	£. 524311	11	3
		3	10
	£. 5243115	12	6
			5
	£. 26215578	2	6
	1572934	13	9
	262155	15	7½
	31458	13	10½
	£. 28082127	5	9

(18)

	l.	s.	d.
Mult.	7124	1	2½
By 7284		4	10
	£. 71240	12	1
		8	10
	£. 712406	00	10
		2	10
	£. 7124060	8	4
			7
	£. 49868422	18	4
	1424812	1	8
	569924	16	8
	28496	4	10
	£. 51891656	1	6

(19)

	l.	s.	d.
Mult.	6573	6	8¼
By 25378		8	10
	£. 65733	6	10½
		7	10
	£. 657333	8	9
		3	10
	£. 6573334	7	6
		5	10
	£. 65733343	15	0
			2
	£. 131466687	10	0
	32866671	17	6
	1972000	6	3
	460133	8	1½
	52586	13	6
	£. 166818079	15	4½

(20)

	l.	s.	d.
Mult.	4187	8	5¾
By 38563		3	10
	£. 41874	4	9½
		6	10
	£. 418742	7	11
		5	10
	£. 4187423	19	2
		8	10
	£. 41874239	11	8
			3
	£. 125622718	15	0
	33499391	13	4
	2093711	19	7
	251245	8	9
	12562	5	5¼
	£. 161479630	2	1¼

In

In the *first Example*, I begin with the least Denomination, *viz. Pence*, saying, 7 Times 9 is 63 *Pence*, that is, 5 *Shillings* and 3 *Pence*, I set down 3 *Pence*, and carry the 5 *Shillings* to the Place of *Shillings*, saying, 7 Times 5 is 35, and 5 is 40, I set down 0 in the first Place of *Shillings*, and carry 4, saying, 7 Times 1 is 7, and 4 that I carry is 11, the *half* of 11 is 5 for *Pounds*, and 1 *remains*, I set down the *remainder* 1 in the second Place of *Shillings*, and carry 5 to the *Pounds*, saying, 7 Times 8 is 56, and 5 that I carry is 61, I set down 1 in the Place of *Pounds*, and carry 6, saying, 7 Times 4 is 28, and 6 is 34, I set down 4, and carry 3, saying, 7 Times 2 is 14, and 3 is 17, I set down 7, and carry 1, saying, 7 Times 7 is 49, and 1 is 50, which being set down, the whole Product is 50741 *l.* 10 *s.* 3 *d.* as in the *Example.*

Example 2d, I begin with the *Pence*, as afore, saying, 9 Times 8 is 72 *Pence*, that is, 6 *Shillings* just, I set down 0 in the Place of *Pence*, and carry 6 *Shillings* to the Place of *Shillings*, saying, 9 Times 4 is 36, and 6 is 42, I set down 2, and carry 4, saying, 9 Times 1 is 9, and 4 is 13, the *half* of 13 is 6 for *Pounds*, and 1 *remains*, I set down 1, and carry 6, saying, 9 Times 5 is 45, and 6 is 51, I set down 1 in the Place of *Pounds*, and carry 5, saying, 9 Times 7 is 63, and 5 is 68, I set down 8, and carry 6, saying, 9 Times 2 is 18, and 6 is 24, I set down 4, and carry 2, saying, 9 Times 6 is 54, and 2 is 56, which being set down, gives 56481 *l.* 12 *s.* 0 *d.* for the *Product*, as in the *Example.*

Example 3, 4, 5, and 6, I first multiply the given Sums by 10, which gives me the *Product* of 10, then in *Example* 3d, the given Sum by 9, it gives the *Product* of 9. Then the *Product* of 10, and the *Product* of 9 added together, gives the *Product* of 19, as in the *Example.* So likewise the *Product*

Product of 10, and the Product of 7 added together, gives the *Product* of 17, as in the 4th *Example*. And the *Product* of 10, and the *Product* of 4 added together, gives the *Product* of 14, as in the 5th Example. And the *Product* of 10, and the *Product* of 6, added together, gives the *Product* of 16, as in the 6th *Example*.

Example 7, 8, 9 and 10. The *Products* of 10 is obtain'd as afore, Then in Example 7, the Product of 10 is multiplied by 3, and it gives the *Product* of 30, because 3 Times 10 is 30. To which I add the *Product* of 6, it gives the *Product* of 36, as in the Example. Again in Example 8, the *Product* of 10, is multiplied by 2, and it gives the *Product* of 20, because 2 Times 10 is 20, to which I add the *Product* of 7, it gives the *Product* of 27, as in the Example.

In Example 9. The *Product* of 10, is multiplied by 4, and it gives the *Product* of 40, because 4 Times 10 is 40; to which I add the *Product* of 7, it gives the *Product* of 47, as in the Example.

In Example 10. The *Product* of 10, is multiplied by 7, and it gives the *Product* of 70, because 7 Times 10, is 70, to which I add the *Product* of 2, it gives the *Product* of 72, as in the Example.

Example 11, 12, 13 and 14. The *Product* of 10, multiplied by 10, gives the *Product* of 100, because 10 Times 10, is 100; then in Example 11, the *Product* of 100, is multiplied by 2, and it gives the *Product* of 200; the *Product* of 10, is multiplied by 7, for the *Product* of 70, and the given Sum multiplied by 3, for the *Product* of 3; then the *Product* of 200, the *Product* of 70, and the *Product* of 3, added together, gives the *Product* of 273, as in the Example.

In *Example* 12. The *Product* of 100 is multiplied by 5, for the *Product* of 500, and the *Product* of 10 by 9, for the *Product* of 90, and the given

given Sum by 2, for the *Product* of 2, these 3 *Products* added together, gives the *Product* of 592, as in the Example.

In *Example* 13. The *Product* of 100 is multiplied by 3, for the *Product* of 300, the *Product* of 10 by 7, for the *Product* of 70, and the given Sum by 4, for the *Product* of 4; these 3 *Products* added together, gives the *Product* of 374, as in the Example.

Example 14. The *Product* of 100 is multiplied by 6, for the *Product* of 600, and the *Product* of 10 by 7, for the *Product* of 70, and the given Sum by 5, for the *Product* of 5; these 3 *Products* added together, gives the *Product* of 675, as in the Example.

Example 15, 16, 17, and 18. The *Products* of 100 are multiplied by 10, and it gives the *Products* of 1000, because 10 Times 100 is 1000. Then in *Example* 15. The *Product* of 1000 is multiplied by 2, for the *Product* of 2000, and the *Product* of 100 by 3, for the *Product* of 300, and the *Product* of 10 by 7, for the *Product* of 70, and the given Sum by 5, for the *Product* of 5. These 4 *Products* added together, gives the *Product* of 2375, as in the Example. The like is to be underſtood with reſpect to the 16, 17, and 18 *Examples*.

Example 19 and 20. The *Products* of 1000 are multiplied by 10, for the *Products* of 10000; and in *Example* 19, the *Product* of 10000 is multiplied by 2, for the *Product* of 20000, and the *Product* of 1000 by 5, for the *Product* of 5000, and the *Product* of 100 by 3, for the *Product* of 300, and the *Product* of 10 by 7, for the *Product* of 70, and the given Sum by 8, for the *Product* of 8; these 5 *Products* added together, gives the *Product* of 25378, as in the Example.

The like is to be underſtood, with reſpect to the 20th *Example*.

To

To *divide Money* by a certain Number proposed, comes next under Consideration, and herein I shall be brief, because its Use, in accompting for the Parts of Quantity, falls generally under some one or other of these Numbers, *viz.* 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, or 12, as will be evident hereafter.

	l.	*s.*	*d.*
2)	5785	16	$8\frac{1}{2}$
£.	2892	18	$4\frac{1}{4}$

	l.	*s.*	*d.*
3)	6524	11	$10\frac{1}{4}$
£.	2174	17	$3\frac{1}{4}$ - 2

	l.	*s.*	*d.*
4)	3248	19	$4\frac{3}{4}$
£.	812	4	10 - 3

	l.	*s.*	*d.*
5)	9728	14	$11\frac{1}{4}$
£.	1945	14	$11\frac{3}{4}$ - 2

	l.	*s.*	*d.*
6)	6275	14	$11\frac{1}{2}$
£.	1045	19	$1\frac{3}{4}$ - 4

	l.	*s.*	*d.*
7)	5834	16	$7\frac{1}{2}$
£.	833	10	$11\frac{1}{4}$ - 3

	l.	*s.*	*d.*
8)	6785	16	$8\frac{3}{4}$
£.	848	4	7 - 3

	l.	*s.*	*d.*
9)	5326	19	$11\frac{3}{4}$
£.	591	17	$9\frac{1}{4}$ - 2

	l.	*s.*	*d.*
10)	8257	19	$7\frac{3}{4}$
£.	825	15	$11\frac{1}{2}$ - 3

	l.	*s.*	*d.*
12)	2794	18	$11\frac{1}{2}$
£.	232	18	$2\frac{1}{4}$ - 10

In the 1st *Example*, I begin with the *Pounds*, and see how many Times 2 the *Divisor*, is contained in 5, which is 2 Times, and 1 remains, I set down 2, and carry 1 to the next Figure, and see how often 2 is contained in 17, which is 8 Times, and 1 remains, I set down 8, and carry 1 to the next Figure, and see how often 2 is contained in 18, which is 9 Times, and 0 remains, I set

set down 9, and because 0 remained, I see how often 2 is contained in 5, which is 2 Times, and 1 remains, I set down 2, and the 1 *Pound* which remained I carry to the *Shillings*, saying, 1 *Pound* is 20 *Shillings*, and 16 *Shillings* is 36 *Shillings*, then I see how often 2 is contained in 36, which is 18, and 0 remains, I set down 18 in the Place of *Shillings*, and proceed to the *Pence*, and see how often 2 is contained in 8, which is just 4 Times, I set down 4 in the Place of *Pence*, and proceed to the *Farthings*, and see how often 2 is contained in 2 *Farthings*, which is just one Time, I set down 1 *Farthing*, and the *Example* is finished.

Example 10. I begin with the *Pounds* as afore, and see how often 12 is contained in 27, which is 2 Times, and 3 remains, I set down 2, and carry 3 to the next Figure, and see how often 12 is contained in 39, which is 3 Times, and 3 remains, I set down 3, and carry 3 to the next Figure, and see how often 12 is contained in 34, which is 2 Times, and 10 remains, I set down 2, and carry the 10 *Pound*, which is 200 *Shillings* that remained, to the *Shillings*, and it makes 218 *Shillings*, then I see how often 12 is contained in 218, which is 18 Times, and 2 remains, I set down 18 in the Place of *Shillings*, and carry 2 *Shillings*, which is 24 *Pence*, to the *Pence*, and it makes 35 *Pence*, then I see often 12 is contained in 35, which is 2 Times, and 11 remains, I set down 2 in the Place of *Pence*, and carry 11 *Pence*, which is 44 *Farthings*, to the *Farthings*, and it makes 46 *Farthings*, then I see how often 12 is contained in 46, which is 3 Times, and 10 remains, I set down the 3 *Farthings* in the Place of *Farthings*, and the 10 that remained, separated by a Mark of Distinction, and the *Example* is finished, so that 2794*l.* 18*s.* 11*d.* $\frac{1}{2}$. divided by 12, or into 12 equal Parts, is 232*l.* 18*s.* 2*d.* $\frac{3}{4}$. and $\frac{10}{12}$, or $\frac{5}{6}$ of a *Farthing*.

In like Manner are the reſt of the *Examples* wrought, which I leave to the Learner.

Of WEIGHT.

THERE are three Sorts of *Weight* uſed in *Great Britain, viz. Troy, Apothecary*'s, and *Averdupoize.*

The leaſt Denomination of *Troy Weight* is a *Grain*, from whence ariſeth the following Table, *viz.*

24	Grains	make	1 Penyweight.
20	Penyweight	------	1 Ounce.
12	Ounces	---------	1 Pound.

By *Troy Weight*, is weighed, *Jewels, Gold, Silver, Corn, Bread*, and all *Liquors*,

The leaſt Denomination of *Apothecary's Weight*, is alſo a *Grain*, from whence ariſeth this Table, *viz.*

20	Grains	-----	a Scruple.
3	Scruples	----	a Dram.
8	Drams	-----	an Ounce.
12	Ounces	-----	a Pound.

By *Apothecary's Weight*, is weighed ſuch Commodities only, wherewith the *Apothecary* Compounds his Medicines.

The leaſt Denomination of *Averdupoize Weight*, is a *Dram*, from whence ariſeth the following Table, *viz.*

16	Drams	make	1 Ounce.
16	Ounces	-------	1 Pound.
28	Pounds	-------	1 Quarter.
4	Quarters	------	1 Hundred w^{t}.
20	Hundred w^{t}.	---	1 Ton.

By

By *Averdupoize Weight*, is weighed all ſuch Commodities, as are either very courſe and droſſy, or very ſubject to waſte, as all Kinds of *Grocery Wares*, and *Pitch*, *Tar*, *Roſin*, *Wax*, *Tallow*, *Soap*, *Flax*, &c. *Copper*, *Tin*, *Steel*, *Iron*, *Lead*, *&c.* alſo *Fleſh*, *Butter*, *Cheeſe*, *Salt*, &c.

The Pound *Troy* and *Apothecary's* are both equal, and leſs than the Pound *Averdupoize*, by about a *ſixth* Part; for the Pound *Averdupoize* contains 14 Ounces, 11 Penyweight, $15\frac{1}{2}$ Grains *Troy*.

	℔	oz.	dwt	gr.
	2719	10	11	13
	3126	11	12	19
	4719	10	13	21
	2832	9	14	23
	7193	8	15	11
	4268	11	16	14
lb.	24862	3	5	5

	℔	℥	dr.	ʒ	gr.
	5167	11	3	2	10
	2842	10	2	2	11
	3719	9	1	2	12
	5672	8	3	2	13
	1428	7	4	1	14
	3719	6	5	1	15
lb.	22551	5	6	1	15

	Ton.	C.	qr.	℔	℥	dr.
	6719	13	2	10	11	10
	3126	14	3	11	12	11
	7149	15	2	19	13	12
	2873	16	2	21	14	13
	2197	17	1	25	15	14
	4137	18	3	27	14	15
Tons	26205	17	1	6	3	11

	℔	oz.	dwt	gr.
From	2279	10	7	11
Take	1976	7	13	5
Rem. lb.	303	2	14	6

	℔	dwt	dr.	ſc.	gr.
	3712	10	1	1	10
	2719	11	2	2	19
lb.	992	10	6	1	11

	Ton.	C	qr.	lb	oz	dr.
Received	157	10	3	11	10	10
Delivered	79	13	1	19	11	7
Remains Ton.	77	17	1	19	15	3

I think it is needleſs to explain the aforegoing *Operations*; what has been already done in *Money*, is ſufficient.

For the like is to be underſtood, both in *Weight* and *Meaſure*, to which I proceed.

Of MEASURE.

THERE are 5 Sorts of *Meaſure* uſed in *Great Britain*, viz. *Liquid Meaſure*, *Dry Meaſure*, *Long Meaſure*, *Land Meaſure*, *Cloth Meaſure*. To which may be added, the *Meaſure* of *Time*.

The leaſt Denomination of *Liquid Meaſure*, is a *Pint* (and 2 Sorts of *Liquid Meaſure* are uſed, *viz. Wine*, and *Beer*) from whence ariſeth the following Tables.

Wine Meaſure.

2 Pints	make	1 Quart.
4 Quarts	- - - -	1 Gallon.
63 Gallons	- - -	1 Hogſhead.
4 Hogſheads	- -	1 Tun.

Beer Meaſure.

2 Pints	make	1 Quart.
4 Quarts	- - - - -	1 Gallon.
8½ Gallons	- - -	1 Firkin.
2 Firkins	- - - -	1 Kilderkin.
2 Kilderkins	- -	1 Barrel.
1½ Barrel	- - - -	1 Hogſhead.
2 Hogſheads	- -	1 Butt.
2 Butts	- - - - -	1 Tun.

Note. In *London*, there is a Diſtinction between *Ale* and *Beer Meaſure*, *viz.* that 8 *Gallons* make a *Firkin*

Firkin of *Ale*, and 9 *Gallons* a *Firkin* of *Beer*. But in all other Parts, it is meaſured, as in the Table.

The *Ale* and *Beer Pint* are both equal, and do exceed the *Wine Pint*, by almoſt *one fifth* Part; accounting 28⅞ *Cubic* Inches, to contain a *Pint* of *Wine*.

The leaſt Denomination of *Dry Meaſure* is alſo a *Pint*, which is leſs than the *Ale* and *Beer Pint*, by almoſt a *two and twentieth Part*, and greater than a *Wine Pint*, by a little more than *one ſixth Part*; from whence ariſeth the following Table, *viz.*

2	Pints	make	1 Quart.
4	Quarts	- - - - - - -	1 Gallon.
2	Gallons	- - - - - - -	1 Peck.
4	Pecks	- - - - - - - -	1 Buſhel.
8	Buſhels	- - - - - - -	1 Quarter.
10	Quarter	- - - - - - -	1 Laſt.

The leaſt Denomination of *Long Meaſure* is a *Barly Corn*; from whence ariſeth this Table, *viz.*

3	Barly Corns	make	1 Inch.
12	Inches	- - - - - - - - - - -	1 Foot.
3	Feet	- - - - - - - - - - - -	1 Yard.
20	Yards	- - - - - - - - - - -	1 Score.
11	Score	- - - - - - - - - - -	1 Furlong.
8	Furlongs	- - - - - - - - -	1 Mile.
3	Miles	- - - - - - - - - - -	1 League.
20	Leagues	- - - - - - - - -	1 Degree.

Note. By an Experiment made by Mr. *Norwood*, betwixt *London* and *York*, *Anno* 1635, it was found that 23 *Leagues*, 4 *Furlongs*, 80 *Yards* do make a *Degree* on the Surface of the Earth and Sea; though it is ſtill the Practice of Mariners to account but 20 *Leagues* to a *Degree*.

The

The least Denomination of *Land Measure*, that is generally used, is a Foot; from whence ariseth this Table, *viz.*

3	Feet	make	1 Yard.
$5\frac{1}{2}$	Yards	- - - - - -	1 Pole or Perch.
40	Square Pole	- -	1 Rood
4	Rood	- - - - - - -	1 Acre.

The least Denomination of *Cloth Measure*, is a *Nail*; from whence ariseth this Table, *viz.*

4	Nails	make	1 Quarter.
4	Quarters	- - - - - -	1 Yard.
5	Quarters	- - - - - -	1 Ell.

A *Flemish Ell* is sometimes used, which contains 3 *Quarters.*

The least Part of *Time*, that can be measured by a mechanick Instrument, as a Clock, Watch, *&c.* is a *Second*; from whence ariseth the following Table, *viz.*

60	Seconds	make	1 Minute.
60	Minutes	- - - - - - -	1 Hour.
24	Hours	- - - - - - - - -	1 Day.
7	Days	- - - - - - - - - -	1 Week.
4	Weeks	- - - - - - - -	1 Month.
13	m. 1 d. 6 h.	- - - -	1 Year.

The Sun apparently compleats its Revolution, according to Modern Observations, in 365 *Days*, 5 *Hours*, 48 *Minutes*, 57 *Seconds*, &c. which Space of Time is called a Solar Year; and is 11 *Minutes*, 3 *Seconds* less than the common Year used with us: And from hence comes that Difference, there is between the *Old* Stile and the *New.*

Tuns

	Tuns	hhds	ga.	qu.	pi.
	37124	2	21	3	1
	26719	2	32	3	1
	31274	2	44	3	0
	65372	3	56	2	1
	84268	3	61	2	1
	27197	2	28	1	1
T.	271958	1	57	0	1

	Last	qu.	bu.	pe	ga.	qu.	pi.
	27597	5	5	2	1	2	1
	31267	6	6	2	1	3	1
	42719	7	7	3	1	2	1
	56718	8	6	3	1	3	1
	37192	9	5	2	1	2	1
	82428	8	4	1	1	1	1
L.	277925	7	5	2	0	0	0

	Deg.	le.	m.	fu.	sc.	ya.	fe.	in.	ba.
	157	13	2	3	7	13	2	10	2
	113	14	2	4	8	14	1	11	2
	27	15	2	5	9	15	1	10	1
	19	16	2	6	8	16	1	9	1
	8	17	1	7	7	17	1	8	1
	7	18	1	0	8	18	2	7	2
D.	335	17	1	5	7	17	0	10	0

	Acres	ro.	po.	ya.
	27194	3	27	5
	12346	2	39	4½
	51297	2	18	3
	18671	3	26	2½
	42719	3	34	1
	53718	1	15	2½
A.	205949	2	2	2

	Ells	qa.	na.
	267	2	2
	164	3	2
	159	4	2
	718	3	1
	271	2	1
	926	1	3
E.	2508	2	3

	Yards	qa.	na.
	471	3	2
	375	2	1
	264	2	1
	197	3	3
	548	2	3
	352	1	1
Y.	2210	3	3

	Mo.	w.	d.	h.	m.
	971	2	5	13	27
	719	3	6	14	30
	719	1	5	15	22
	137	1	4	19	19
	719	2	3	22	50
	837	2	2	11	40
M.	4105	3	1	1	8

	Tuns	hhds	ga.	qu.	pi.
Bought	7129	2	21	2	1
Sold	4827	3	13	3	1
Unsol T.	2301	3	7	3	0

	Last	qu.	bu.	pe.	ga.	qu.	pi.
	359	3	7	3	1	2	0
	260	6	5	3	1	3	1
L.	98	7	1	3	1	2	1

	Deg.	le.	m.	fu.	sc.	ya.	fe.	in.	ba.
From	259	13	2	7	10	13	1	10	2
Take	168	12	1	5	7	10	2	11	1
Re. Deg.	91	01	1	2	3	2	1	11	1

	Acr.	ro.	po.	ya.
	719	3	13	3
	532	2	20	4
A.	187	0	32	4½

	Ells	qa.	na.
From	5794	2	3
Take	5729	4	1
Rem. E.	64	3	2

	Yds.	qa.	na.
	3679	1	2
	2572	2	3
Y.	1106	2	3

	Mon.	w.	da.	ho.	m.	se.
	946	2	3	17	11	10
	872	3	4	10	13	23
M.	73	2	6	6	57	47

I have

I have omitted giving any Examples of *Multiplication* and *Division*, in *Weight* and *Measure*, as but of little uſe, and differing from that of *Money*, only in the Denomination of its Parts; it being my Deſign to render this Treatiſe as compendious and uſeful as I am able, and therefore ſhall now proceed to ſhew, how eaſily the *Amount* of any *Quantity* at any *Price*, may be obtained by one eaſy general Rule, *viz.*

RULE.

Multiply the *Price* by the *Quantity*.

		d.	
9 Pound at		$10\frac{1}{2}$	*per* ℔
		9	
Sh.	7	$10\frac{1}{2}$	

		d.	
10 Pounds at		$9\frac{3}{4}$	*per* ℔
		10	
Sh.	8	$1\frac{1}{2}$	

		s.	d.	
17 Yards at		3	6	*per* Y.
		7	10	
£.	1	15	0	
	1	4	6	
£.	2	19	6	

		s.	d.	
18 Yds. at		13	4	*per* Y.
		8	10	
£.	6	13	4	
	5	6	8	
£.	12	0	0	

		s.	d.	
25 Ells at		5	$10\frac{1}{4}$	*per* E.
		5	10	
£.	2	18	$6\frac{1}{2}$	
			2	
£.	5	17	1	
	1	9	$3\frac{1}{4}$	
£.	7	6	$4\frac{1}{4}$	

		s.	d.	
36 Ells at		11	$5\frac{1}{4}$	*per* E.
		6	10	
£.	5	14	7	
			3	
£.	17	3	9	
	3	8	9	
£.	20	12	6	

Becauſe

Because 5 Times 5 is 25, and 6 Times 6 is 36: The two preceeding Examples may be more compendiously wrought as follows.

		d.	*s.*	
25 Ells at		5	10¼	*per* E.
			5	
£.	1	9	3½	
			5	
£.	7	6	4¼	

		s.	*d.*	
36 Ells at		11	5½	*per* E.
			6	
£.	3	8	9	
			6	
£.	20	12	6	

		s.	*d.*	
244 Doz. at		6	8	*per* D.
		4	10	
£.	3	6	8	
		4	10	
£.	33	6	8	
			2	
£.	66	13	4	
	13	6	8	
	1	6	8	
£.	81	6	8	

		s.	*d.*	
353 Doz. at		16	9	*per* D.
		3	10	
£.	8	7	6	
		5	10	
£.	83	15	0	
			3	
£.	251	5	0	
	41	17	6	
	2	10	3	
£.	295	12	9	

	l.	*s.*	*d.*	
2475 ⊕ at	1	3	6	*per* ⊕
		5	10	
£.	11	15	0	
		7	10	
£.	117	10	0	
		4	10	
£.	1175	0	0	
			2	
£.	2350	0	0	
	470	0	0	
	82	5	0	
	5	17	6	
£.	2908	2	6	

	l.	*s.*	*d.*	
3895 ⊕ at	2	14	5	*per* ⊕.
		5	10	
£.	27	4	2	
		9	10	
£.	272	1	8	
		8	10	
£.	2720	16	8	
			3	
£.	8162	10	0	
	2176	13	4	
	244	17	6	
	13	12	1	
£.	10597	12	11	

Yds.		*l.*	*s.*	*d.*	
7¼	at	1	3	6	*per* Y.
				7	
	£.	8	4	6	
¼ Y.			5	10½	
	£.	8	10	4½	

Yds.		*l.*	*s.*	*d.*	
8¼	at	1	19	6	*per* Y.
				8	
	£.	15	16	0	
¼ Y.			9	10½	
	£.	16	5	10½	

Yds.		*l.*	*s.*	*d.*	
16½	at	2	14	8	*per* Y.
			6	10	
	£.	27	6	8	
		16	8	0	
½ Y.		1	7	4	
	£.	45	2	0	

Yds.		*l.*	*s.*	*d.*	
15½	at	3	12	10	*per* Y.
			5	10	
	£.	36	8	4	
		18	4	2	
½ Y.		1	16	5	
	£.	56	8	11	

⊕		*l.*	*s.*	*d.*	
35¾	at	1	17	9	*per* ⊕
			5	10	
	£.	18	17	6	
				3	
	£.	56	12	6	
		9	8	9	
½ ⊕			18	10½	
¼ ⊕			9	5¼	
	£.	67	9	6¾	

⊕		*l.*	*s.*	*d.*	
54¾	at	1	12	11	*per* ⊕
			4	10	
	£.	26	9	2	
				5	
	£.	132	5	10	
		10	11	8	
½ ⊕		1	6	5½	
¼ ⊕			13	2¾	
	£.	144	17	2¼	

The preceeding *Examples* are ſo plain, that I think it ſuperfluous to add any thing thereupon.

Wares ſold by the Stone.

If the Stone conſiſt of 8 Pounds. Then

4 ℔	will be	½	of a Stone.
3	- - - - - - - - - -	⅓	
2	- - - - - - - - - -	¼	
1	- - - - - - - - - -	⅛	

Wares

st.	*lb.*			*s.*	*d.*	
6	7	at		2	3	*per* Stone.
					6	
			Sh.	13	6	
4 *lb.*				1	1½	
2					6¾	
1					3¼	
			Sh.	15	5½	

st.	*lb.*		*l.*	*s.*	*d.*	
8	7	at		3	4¼	*per* Stone.
					8	
			£. 1	6	10	
4 *lb.*				1	8	
2					10	
1					5	
			£. 1	9	9	

st.	*lb.*		*l.*	*s.*	*d.*	
12	5	at		14	8¼	*per* Stone.
				2	10	
			£. 7	7	3½	
			1	9	5½	
4 *lb.*				7	4¼	
1				1	10	
			£. 9	5	11¼	

st.	*lb.*		*l.*	*s.*	*d.*	
14	5	at		15	9¼	*per* Stone.
				4	10	
			£. 7	17	8½	
			3	3	1	
4 *lb.*				7	10½	
1				1	11½	
			£. 11	10	7½	

st.	*lb.*		*l.*	*s.*	*d.*	
25	3	at		3	6½	*per* Stone.
				5	10	
			£. 1	15	5	
					2	
			£. 3	10	10	
				17	8½	
2 *lb.*					10½	
1					5¼	
			£. 4	9	10¼	

st.	*lb.*		*l.*	*s.*	*d.*	
36	3	at		4	11¾	*per* Stone.
				6	10	
			£. 2	9	9½	
					3	
			£. 7	9	4½	
			1	9	10½	
2 *lb.*				1	2¾	
1					7¼	
			£. 9	1	1	

st.	*lb.*		*l.*	*s.*	*d.*	
496	1	at	1	7	6	*per* S.
				6	10	
			£. 13	15	0	
				9	10	
			£. 137	10	0	
					4	
			£. 550	0	0	
			123	15	0	
			8	5	0	
1 *lb.*				3	5¼	
			£. 682	3	5¼	

st.	*lb.*		*l.*	*s.*	*d.*	
578	1	at	2	14	8	*per* S.
				8	10	
			£. 27	6	8	
				7	10	
			£. 273	6	8	
					5	
			£. 1366	13	4	
			191	6	8	
			21	17	4	
1 *lb.*				6	10	
			£. 1580	4	2	

In the preceeding *Examples*, to obtain the Price of the *Pounds*, the Price of one *Stone* is divided by 2, for the Price of 4 *lb.* becauſe 4 *lb.* is the half of a Stone, the half of the Price of 4 *lb.* is the Price of 2 *lb.* and half Price of 2 *lb*, is the Price of 1 *lb.*

Alſo the Price of 4 *lb.* divided by 4, gives the Price of 1 *lb.* again, the Price of a *Stone*, divided by 4, gives the Price of 2 *lb*, and the Price of a *Stone* divided by 8, gives the Price of 1 *lb.*

The Stone of 8 *lb.* is uſed by *Butchers*, and Sellers of Fleſh. But the Stone uſed in *Merchandize*, contains 14 *lb.* the even Parts of which are, *viz.*

7 *lb.* the $\frac{1}{2}$ } of a Stone.
2 . . . . $\frac{1}{7}$ }

ſto.	*lb.*		£	*s.*	*d.*	
7	13	at		5	0	*per* Stone.
					7	
			£. 1	15	0	
	7 *lb.*			2	6	
	2			0	8½	
	2			0	8½	
	2			0	8½	
			£. 1	19	7½	

ſto.	*lb.*		£	*s.*	*d.*	
9	13	at		7	6	*per* Stone.
					9	
			£. 3	7	6	
	7 *lb.*			3	9	
	2			1	0¼	
	2			1	0¼	
	2			1	0¼	
			£. 3	14	5¼	

ſto.	*lb.*		£	*s.*	*d.*	
16	12	at		11	4½	*per* Stone.
				6	10	
			£. 5	13	9	
			3	8	3	
	7 *lb.*			5	8¼	
	2			1	7½	
	2			1	7½	
	1				9¾	
			£. 9	11	9	

ſto.	*lb.*		£	*s.*	*d.*	
18	12	at		16	10¼	*per* Stone.
				8	10	
			£. 8	8	6¼	
			6	14	10	
	7 *lb.*			8	5	
	2			2	4¾	
	2			2	4¾	
	1			1	2¼	
			£. 15	17	9¼	

sto.	*lb.*		*l.*	*s.*	*d.*	
35	8	at	1	4	9	*per* Sto.
				5	10	
			£. 12	7	6	
					3	
			£. 37	2	6	
			6	3	9	
7 *lb.*				12	$4\frac{1}{2}$	
1				1	9	
			£. 44	0	$4\frac{1}{2}$	

sto.	*lb.*		*l.*	*s.*	*d.*	
46	8	at	1	14	7	*per* Stone.
				6	10	
			£. 17	5	10	
					4	
			£. 69	3	4	
			10	7	6	
7 *lb.*				17	$3\frac{1}{2}$	
1				2	$5\frac{1}{2}$	
			£. 80	10	7	

sto.	*lb.*		*l.*	*s.*	*d.*	
245	6	at	2	6	$7\frac{1}{4}$	*per* Sto.
				5	10	
			£. 23	6	$0\frac{1}{2}$	
				4	10	
			£. 233	0	5	
					2	
			£. 466	0	10	
			93	4	2	
			11	13	$0\frac{1}{4}$	
2 *lb.*				6	$7\frac{3}{4}$	
2 *lb.*				6	$7\frac{3}{4}$	
2 *lb.*				6	$7\frac{3}{4}$	
			£. 571	17	$11\frac{1}{2}$	

sto.	*lb.*		*l.*	*s.*	*d.*	
386	6	at	2	18	$5\frac{1}{2}$	*per* Sto.
				6	10	
			£. 29	4	7	
				8	10	
			£. 292	6	5	
					3	
			£. 876	19	3	
			233	16	8	
			17	10	9	
2 *lb.*				8	4	
2 *lb.*				8	4	
2 *lb.*				8	4	
			£. 1129	11	8	

sto.	*lb.*		*l.*	*s.*	
3729	1	at	3	10	*per* Sto.
			9	10	
			£. 35	0	
			2	10	
			£. 350	0	
			7	10	
			£. 3500	0	
				3	
			£. 10500	0	
7|3 10			2450	0	
2| 10			70	0	
			31	10	
5	1 *lb.*			5	
			£. 13051	15	

sto.	*lb.*		*l.*	*s.*	*d.*	
4987	1	at	4	11	5	*per* Stone.
				7	10	
			£. 45	14	2	
				8	10	
			£. 457	1	8	
				9	10	
			£. 4570	16	8	
					4	
			£. 18283	6	8	
7|4 11 5			4113	15	0	
2| 13 $0\frac{1}{2}$			364	13	4	
6 $6\frac{1}{4}$			31	19	11	
1 *lb.*				6	$6\frac{1}{4}$	
			£. 22794	1	$5\frac{1}{4}$	

In

In the preceeding Examples, the Price of a Stone is divided by 2, for the Price of 7 ℔, and the Price of a Stone by 7, for the Price of 2 ℔, and the Price of 2 ℔ by 2, for the Price of 1 ℔.

Wares sold by the Dozen.

All the even Parts of a Dozen will be, *viz.*

6 ℔	the	$\frac{1}{2}$	of a Dozen.
4	- - - - - - - -	$\frac{1}{3}$	
3	- - - - - - - - -	$\frac{1}{4}$	
2	- - - - - - - - -	$\frac{1}{6}$	
1	- - - - - - - - -	$\frac{1}{12}$	

D.	lb.			s.	d.	
7	11	at		7	6	*per* Dozen.
					7	
			£. 2	12	6	
6 *lb.*				3	9	
3				1	10½	
2				1	3	
			£. 2	19	4½	

D.	lb.			s.	d.	
9	11	at		13	5	*per* Dozen.
					9	
			£. 6	0	9	
6 *lb.*				6	8½	
3				3	4¼	
2				2	2¾	
			£. 6	13	0½	

D.	lb.		l.	s.	d.	
14	9	at	1	3	6	*per* D.
				4	10	
			£. 11	15	0	
			4	14	0	
6 *lb.*				11	9	
3				5	10½	
			£. 17	6	7½	

D.	lb.		l.	s.	d.	
16	9	at	1	14	9	*per* D.
				6	10	
			£. 17	7	6	
			10	8	6	
6 *lb.*				17	4½	
3				8	8¼	
			£. 29	2	0¾	

D.	lb.			s.	d.	
56	7	at		8	4½	*per* Doz.
				6	10	
			£. 4	3	9	
					5	
			£. 20	18	9	
			2	10	3	
6 *lb.*				4	2¼	
1					8¼	
			£. 23	13	10½	

D.	lb.			s.	d.	
72	7	at		12	5¾	*per* Doz.
				2	10	
			£. 6	4	9½	
					7	
			£. 43	13	6½	
			1	4	11½	
6 *lb.*				6	2¾	
1				1	0¼	
			£. 45	5	9	

D.

doz.	lb.		l.	s.	d.
275	5	at	1	11	6 *per* Doz.
				5	10
			£ 15	15	0
				7	10
			£. 157	10	0
					2
			£. 315	0	0
			110	5	0
			7	17	6
	4 *lb*			10	6
	1			2	$7\frac{1}{2}$
			£. 433	15	$7\frac{1}{2}$

doz.	lb.		l.	s.	d.
482	5	at	1	14	10 *per* Doz.
				2	10
			£. 17	8	4
				8	10
			£. 174	3	4
					4
			£. 696	13	4
			139	6	8
			3	9	8
	4 *lb.*			11	$7\frac{1}{4}$
	1			2	$10\frac{3}{4}$
			£. 840	4	2

doz.	lb.		l.	s.	d.
2756	3	at		8	$11\frac{1}{2}$ *per* Doz.
				6	10
			£. 4	9	7
				5	10
			£. 44	15	10
				7	10
			£. 447	18	4
					2
			£. 895	16	8
			313	10	10
			22	7	11
			2	13	9
	2 *lb.*			1	$5\frac{3}{4}$
	1				$8\frac{3}{4}$
			£. 1234	11	$4\frac{1}{2}$

doz.	lb.		l.	s.	d.
4795	3	at		19	$5\frac{1}{4}$
				5	10
			£. 9	14	$4\frac{1}{2}$
				9	10
			£. 97	3	9
				7	10
			£. 971	17	6
					4
			£. 3887	10	0
			680	6	3
			87	9	$4\frac{1}{2}$
			4	17	$2\frac{1}{4}$
	2 *lb.*			3	$2\frac{3}{4}$
	1			1	$7\frac{1}{4}$
			£. 4660	7	$7\frac{3}{4}$

In the preceeding *Examples*, of Goods ſold by the *Dozen*, the Price of the Pounds are obtained by dividing the Price of 1 *Dozen* by 2, it gives the Price of 6 *Pounds*, the Price of 6 *Pounds* by 2, it gives the Price of 3 *Pounds*, alſo the Price of 6 *Pounds* by 3, gives the Price of 2 *Pounds*. Again, the Price of 6 *Pounds* divided by 6, gives the Price of

of 1 *Pound*, the Price of 1 *Dozen* divided by 3, gives the Price 4 *Pounds*, and the Price of 4 *Pounds* by 4, gives the Price of 1 *Pound*, the Price of 1 *Dozen* divided by 6, gives the Price of 2 *Pounds*, and the Price of 2 *Pounds* by 2, gives the Price of 1 *Pound*.

Wares sold by the Pound.

The even Parts of a Pound *Averdupoize*, will be, *viz.*

8 ℥	the	½	of a Pound.
4	--------	¼	
2	--------	⅛	

℔	℥		s.	d.	
3	15	at	4	6	per ℔
				3	
		Sh.	13	6	
8 ℥			2	3	
4			1	1½	
2				6¾	
1				3¼	
		Sh.	17	8½	

℔	℥			s.	d.	
5	15	at		13	9	per ℔
					5	
		£.	3	8	9	
8 ℥				6	10½	
4				3	5¼	
2				1	8½	
1				0	10¼	
		£.	4	1	7½	

℔	℥		l.	s.	d.	
14	13	at	1	3	4	per ℔
				4	10	
		£.	11	13	4	
			4	13	4	
8 ℥				11	8	
4				5	10	
1				1	5½	
		£.	17	5	7½	

℔	℥		l.	s.	d.	
15	13	at	1	13	9	per ℔
				5	10	
		£.	16	17	6	
			8	8	9	
8 ℥				16	10½	
4				8	5¼	
1				2	1¼	
		£.	26	13	8	

℔ ℥ s. d.
39 11 at 9 $7\frac{1}{2}$ *per* ℔
9 10
£. 4 16 3
3
£. 14 8 9
4 6 $7\frac{1}{2}$
8 ℥ 4 $9\frac{3}{4}$
2 1 $2\frac{1}{4}$
1 7
£. 19 1 $11\frac{1}{2}$

℔ ℥ s. d.
48 11 at 14 $6\frac{1}{4}$ *per* ℔
8 10
£. 7 5 $2\frac{1}{2}$
4
£. 29 0 10
5 16 2
8 ℥ 7 3
2 1 $9\frac{3}{4}$
1 $10\frac{3}{4}$
£. 35 6 $11\frac{1}{2}$

℔ ℥ l. s. d.
376 9 at 2 7 $9\frac{1}{2}$ *per* ℔
6 10
£. 23 17 11
7 10
£. 238 19 2
3
£. 716 17 6
167 5 5
14 6 9
8 ℥ 1 3 $10\frac{3}{4}$
1 2 $11\frac{3}{4}$
899 16 $6\frac{1}{2}$

℔ ℥ l. s. d.
485 9 at 3 16 $4\frac{3}{4}$ *per* ℔
5 10
£. 38 3 $11\frac{1}{2}$
8 10
£. 381 19 7
4
£. 1527 18 4
305 11 8
19 1 $11\frac{3}{4}$
8 ℥ 1 18 $2\frac{1}{4}$
1 4 $9\frac{3}{4}$
1854 14 $11\frac{1}{4}$

℔ ℥ s. d.
2749 7 at 7 $8\frac{1}{8}$ *per* ℔
9 10
£. 3 16 $9\frac{2}{8}$
4 10
£. 38 7 $8\frac{4}{8}$
7 10
£. 383 17 1
2
£. 767 14 2
268 13 $11\frac{4}{8}$
15 7 1
3 9 $1\frac{1}{8}$
4 ℥ 1 11
2 $11\frac{4}{8}$
1 $5\frac{6}{8}$
£. 1055 7 $7\frac{7}{8}$

℔ ℥ s. d.
3127 7 at 16 $11\frac{3}{8}$ *per* ℔
7 10
£. 8 9 $5\frac{6}{8}$
2 10
£. 84 14 $9\frac{4}{8}$
1 10
£. 847 7 11
3
£. 2542 3 9
84 14 $9\frac{4}{8}$
16 18 $11\frac{4}{8}$
5 18 $7\frac{5}{8}$
4 ℥ 4 $2\frac{6}{8}$
2 2 $1\frac{3}{8}$
1 1 $0\frac{4}{8}$
£. 2650 3 $6\frac{1}{8}$

℔ ℥		*l.*	*s.*	*d.*	
4 5	at	1	7	$9\frac{5}{8}$	*per* ℔
				4	
	£.	5	11	$2\frac{4}{8}$	
4 ℥			6	$11\frac{3}{8}$	
1			1	$8\frac{6}{8}$	
	£.	5	19	$10\frac{5}{8}$	

℔ ℥		*l.*	*s.*	*d.*	
6 5	at	2	8	$6\frac{7}{8}$	*per* ℔
				6	
	£.	14	11	$5\frac{2}{8}$	
4 ℥			12	$1\frac{5}{8}$	
1			3	$0\frac{3}{8}$	
	£.	15	6	$7\frac{2}{8}$	

℔ ℥		*l.*	*s.*	*d.*	
12 3	at		4	$3\frac{1}{4}$	*per* ℔
			2	10	
	£.	2	2	$8\frac{1}{2}$	
			8	$6\frac{1}{2}$	
2 ℥				$6\frac{1}{4}$	
1				3	
	£.	2	12	$0\frac{1}{4}$	

℔ ℥		*l.*	*s.*	*d.*	
13 3	at		13	$9\frac{1}{2}$	*per* ℔
			3	10	
	£.	6	17	11	
		2	1	$4\frac{1}{2}$	
2 ℥			1	$8\frac{1}{2}$	
1				$10\frac{1}{4}$	
	£.	9	1	$10\frac{1}{4}$	

℔ ℥		*l.*	*s.*	*d.*
56 1	at	2	7	11
per ℔			6	10
	£.	23	19	2
				5
	£.	119	15	10
		14	7	6
1 ℥			2	$11\frac{3}{4}$
	£.	134	6	$3\frac{1}{4}$

	l.	*s.*	*d.*
4 |	3	7	11
4 |		11	$11\frac{3}{4}$
Sh.		2	$11\frac{3}{4}$

℔ ℥		*l.*	*s.*	*d.*
65 1	at	3	18	9
per ℔			5	10
	£.	39	7	6
				6
	£.	236	5	0
		19	13	9
1 ℥			4	11
	£.	256	3	8

	l.	*s.*	*d.*
4 |	3	18	9
4 |		19	$8\frac{1}{4}$
Sh.		4	11

In the preceeding *Examples*, the Price of the *Ounces* are obtained as followeth, *viz.*

In *Example* 1. I divide the Price of 1 *Pound* by 2, for the Price of 8 *Ounces*, and the Price of 8 ℥ by 2, for the Price of 4 ℥, and the Price of 4 ℥ by 2, for the Price of 2 ℥, and the Price of 2 ℥ by 2, for the Price of 1 ℥.

In *Example* 2. The Price of 4 ℥ is divided by 4, for the Price of 1 ℥.

In

In *Example* 3. The Price of 8 *oz.* is divided by 4, for the Price of 2 *oz.* *&c.*

In *Example* 4. The Price of 8 *oz.* is divided by 8, for the Price of 1 *oz.*

In *Example* 5. The Price of 1 *lb.* is divided by 4, for the Price of 4 *oz.* *&c.*

In *Example* 7. The Price of 1 *lb.* is divided by 8, for the Price of 2 *oz.* *&c.*

In *Example* 8. The Price of 1½ *lb.* is divided by 4, for the Price of 4 *oz.* and the Price of 4 *oz.* by 4, for the Price of 1 *oz.*

Wares sold by the Yard.

The even Parts of a Yard are,

2 Quarters, or	8 Nails, the	½	of a Yard.
1	4	¼	
	2	⅛	

ya.	*qu.*	*na.*		*s.*	
9	3	3	at	6	*per* Yard.
				9	
			£. 2	14	
2 *qrs.*				3	
1 *qr.*				1	6
2 *nails.*					9
1 *nail.*					4½
			£. 2	19	7½

ya.	*qu.*	*na.*			*s.*	*d.*	
8	3	3	at		17	9	*per* Yd.
						8	
				£. 7	2	0	
2 *qrs.*					8	10½	
1 *qr.*					4	5¼	
2 *nails.*					2	2½	
1 *nail.*					1	1¼	
				£. 7	18	7½	

ya.	*qu.*	*na.*		*l.*	*s.*	*d.*	
13	3	1	at	1	7	6	*per* Yard.
					3	10	
				£. 13	15	0	
				4	2	6	
2 *qrs.*					13	9	
1 *qr.*					6	10½	
1 *nail*					1	8½	
				£. 18	19	10	

ya.	*qrs.*	*na.*			*s.*	*d.*	
17	3	1	at		4	10	*per* Yd.
					7	10	
				£. 2	8	4	
				1	13	10	
2 *qrs.*					2	5	
1 *qr.*					1	2½	
1 *nail.*						3½	
				£. 4	6	1	

ya. qu. na. *s.* *d.*
75 1 1 at 14 $9\frac{1}{4}$ *per* Yard.
5 10
£. 7 7 $8\frac{1}{2}$
7
£. 51 13 $11\frac{1}{2}$
3 13 $10\frac{3}{4}$
1 *qr.* . . . . . . 3 $8\frac{1}{4}$
1 *nail* 11
£. 55 12 5

ya. qu. na.
67 1 1 at 12 Shil. *per* Yd.
7 10
£. 6 0
6
£. 36 0
4 4
1 *qu.* 3
1 *nail.* 0 9
£. 40 7 9

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yar. qu. na. *s.* *d.*
352 2 1 at 5 9 *per* Yd.
2 10
£. 2 17 6
5 10
£. 28 15 0
3
£. 86 5 0
14 7 6
11 6
2 *qrs.* . . . . 2 $10\frac{1}{2}$
1 *nail* . . . . $4\frac{1}{4}$
£. 101 7 $2\frac{3}{4}$

yar. qu. na. *l.* *s.* *d.*
564 2 1 at 3 12 $8\frac{1}{2}$ *per* Yard.
4 10
£. 36 7 1
6 10
£. 363 10 10
5
£. 1817 14 2
218 2 6
14 10 10
2 *qrs.* . . . . 1 16 $4\frac{1}{4}$
1 *nail* . . . . 4 $6\frac{1}{2}$
£. 2052 8 $4\frac{3}{4}$

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yards qu. na. *l.* *s.*
3728 0 3 at 1 13 *per* Yard.
8 10
£. 16 10
2 10
£. 165 0
7 10
£. 1650 0
3
£. 4950 0
1155 0
33 0
13 4
2 *nails* . . . . 4 $1\frac{1}{2}$
1 *nail* . . . . 2 $0\frac{3}{4}$
£. 6151 10 $2\frac{1}{4}$

yards qu. na. *l.* *s.* *d.*
4875 0 3 at 2 12 11 *per* Yard.
5 10
£. 26 9 2
7 10
£. 264 11 8
8 10
£. 2645 16 8
4
£. 10583 6 8
2116 13 4
185 4 2
13 4 7
2 *nails* . . . . 6 $7\frac{1}{4}$
1 *nail* . . . . 3 $3\frac{1}{2}$
£. 12898 18 $7\frac{3}{4}$

ya.

	ya. qu. na.		*l.*	*s.*	*d.*
	7 0 1	at	2	7	8
	per Yard.				7
4	2 7 8	£.	16	13	8
4	11 11	1 *nail* . .		2	$11\frac{3}{4}$
	Sb. 2 $11\frac{3}{4}$	£.	16	16	$7\frac{3}{4}$

	ya. qu. na.		*l.*	*s.*	*d.*
	9 0 1	at	3	5	6
	per Yard.				9
4	3 5 6	£.	29	9	6
4	16 $4\frac{1}{2}$	1 *nail* . . .		4	1
	Sb. . . 4 1	£.	29	13	7

The *Quarters*, and *Nails* in the preceeding *Examples*, are obtained as followeth, *viz.*

In *Example* 1. I divide the Price of a Yard by 2, for the Price of 2 qrs. and the Price of 2 qrs. by 2, for the Price of 1 qr. then the Price of 1 qr. by 2, for the Price of 2 *Nails*, and the Price of 2 *Nails* by 2, for the Price of 1 *Nail.*

In *Example* 2. I divide the Price of 1 qr. by 4, for the Price of 1 *Nail.*

In *Example* 3. I divide the Price of 1 *Yard* by 4, for the Price of 1 qr. &c.

In *Example* 4. I divide the Price of 2 qrs. by 8, for the Price of 1 *Nail.*

In *Example* 5. I divide the Price of 1 *Yard*, by 8, for the Price of 2 *Nails*, &c.

In *Example* 6. I divide the Price of 1 *Yard* by 4, it gives the Price of 1 qr. which divided by 4, gives the Price of 1 *Nail.*

Wares sold by the Hundred Weight.

The even Parts of an Hundred Weight.

2 *qrs.* or	56 *lb.*	the $\frac{1}{2}$	of an ⊕
1	28	$\frac{1}{4}$	
	16	$\frac{1}{7}$	
	14	$\frac{1}{8}$	

Note, 16 *Pounds* being $\frac{1}{7}$ Part of 112 *Pounds*, or *One hundred Weight*, I shall wholly make Use thereof, in obtaining the Price of the *Pounds*, in the following *Examples*.

⊕ *qu.* ℔		*s.*	
9 3 27 at		14	*per* ⊕
		9	
	£. 6	6	
2 *qu.* -------		7	
1 *qu.* -------		3	6
16 *lb.* -------		2	0
8 *lb.* -------		1	0
2 *lb.* ---------			3
1 *lb.* ---------			1½
	£. 6	19	10½

⊕ *qu. lb.*		*s.*	*d.*
8 3 27 at		16	11 *per*
⊕			8
	£. 6	15	4
2 *qu.* -------		8	5½
1 *qu.* -------		4	2¾
16 *lb.* -------		2	5
8 *lb.* -------		1	2½
2 *lb.* ---------			3½
1 *lb.* ---------			1¾
	£. 7	12	1

⊕ *qu. lb.*	*l.*	*s.*	*d.*
17 2 25 at	1	13	10
per ⊕		7	10
	£. 16	18	4
	11	16	10
2 *qu.* --------		16	11
16 *lb.* --------		4	10
8 *lb.* --------		2	5
1 *lb.* ----------			3½
	£. 29	19	7½

⊕ *qu. lb.*	*l.*	*s.*	*d.*
15 2 25 at	2	16	8
per ⊕		5	10
	£. 28	6	8
	14	3	4
2 *qu.* ------	1	8	4
16 *lb.* --------		8	1
8 *lb.* --------		4	0¾
1 *lb.* ----------			6
	£. 44	10	11½

⊕ *qu.* ℔		*s.*	*d.*
37 2 23 at		18	9½ *per*
⊕		7	10
	£. 9	7	11
			3
	£. 28	3	9
	6	11	6½
2 *qu.* -------		9	4¾
16 ℔ -------		2	8
4 ----------			8
2 ----------			4
1 ----------			2
	£. 35	8	6¼

⊕ *qu.* ℔		*s.*	*d.*
49 2 23 at		19	11¼ *per*
⊕		9	10
	£. 9	19	9½
			4
	£. 39	19	2
	8	19	9¾
2 *qu.* ------		9	11¾
16 ℔ -------		2	10¼
4 -----------			8½
2 -----------			4¼
1 -----------			2
	£. 49	13	0½

⊕

⊕ qu. ℔	l.	s.	d.
375 3 21 at	2	17	8
per ⊕		5	10
£.	28	16	8
		7	10
£.	288	6	8
			3
£.	865	0	0
	201	16	8
	14	8	4
2 *qu.* - - - - - - -	1	8	10
1 *qu.* - - - - - - - -		14	5
16 ℔ - - - - - - - -		8	2$\frac{1}{4}$
4 ℔ - - - - - - - -		2	0$\frac{1}{2}$
1 ℔ - - - - - - - - - -			6
£.	1083	19	0$\frac{1}{4}$

⊕ qu. ℔	l.	s.	d.
486 3 21 at	2	16	10
per ⊕		6	10
£.	28	8	4
		8	10
£.	284	3	4
			4
£.	1136	13	4
	227	6	8
	17	1	0
2 *qu.* - - - - - -	1	8	5
1 *qu.* - - - - - - - -		14	2$\frac{1}{2}$
16 ℔ - - - - - - - -		8	1$\frac{1}{4}$
4 ℔ - - - - - - - -		2	0$\frac{1}{4}$
1 ℔ - - - - - - - - - -			6
£.	1383	14	3

⊕ qu. ℔		s.	d.
3756 1 19 at		9	7
per ⊕		6	10
£.	4	15	10
		5	10
£.	47	18	4
		7	10
£.	479	3	4
			3
£.	1437	10	0
	325	8	4
	23	19	2
	2	17	6
1 *qu.* : : : : : : : : : :		2	4$\frac{3}{4}$
16 ℔ : : : : : : : : :		1	4$\frac{1}{4}$
2 ℔ : : : : : : : : : : : :			2
1 ℔ : : : : : : : : : : : :			1
£.	1799	19	0

⊕ qu. ℔		s.	d.
4287 1 19 at		10	11
per ⊕		7	10
£.	5	9	2
		8	10
£.	54	11	8
		2	10
£.	545	16	8
			4
£.	2183	6	8
	109	3	4
	43	13	4
	3	16	5
1 *qu.* : : : : : : : : : :		2	8$\frac{3}{4}$
16 ℔ : : : : : : : : :		1	6$\frac{1}{2}$
2 ℔ : : : : : : : : : : : :			2$\frac{1}{4}$
1 ℔ : : : : : : : : : : : :			1
£.	2340	4	3$\frac{1}{2}$

The *Quarters* and *Pounds* in the preceeding Examples, are obtained as followeth, *viz.*

In *Example* 1. The Price of 1 ⊕ is divided by 2, for the Price of 2 *Quarters*, and the Price of 2 *Quarters* by 2, for the Price of 1 *Quarter*. Again, the Price of 1 ⊕ is divided by 7, for the Price of 16 *lb.* the Price of 16 *lb.* by 2, for the Price of 8 *lb.* the Price of 8 *lb.* by 4, for the Price of 2 *lb.* and the Price of 2 *lb.* by 2, for the Price of 1 *lb.*

In *Example* 2. The Price of 8 *lb.* is divided by 8, for the Price of 1 *lb.*

In *Example* 3. The Price of 16 *lb.* is divided by 4, for the Price of 4 *lb.* and the Price of 4 *lb.* by 2, for the Price of 2 *lb.* and the Price of 2 *lb.* by 2, for the Price of 1 *lb.*

In *Example* 4. The Price of 16 *lb.* divided by 4, gives the Price of 4 *lb.* and the Price of 4 *lb.* divided by 4, gives the Price of 1 *lb.*

In *Example* 5. The Price of 16 *lb.* divided by 8, gives the Price of 2 *lb.* &c.

It is to be obſerved, that in *Wares* bought and ſold by the *Hundred Weight*; there is ſometimes an Allowance to be made for *Tare* and *Trett*; and then, *Groſs* is the Weight of a Commodity, with the Hogſhead, Cheſt, or Box, or whatſoever elſe contains it.

Tare is the Weight of the Hogſhead, Cheſt, or Box, and is ſometimes rated at a certain Number of *Pounds per Hundred Weight*.

Trett is an Allowance of 4 *Pounds*, in every 104 *Pounds*, for Waſte and Duſt, on ſome Sorts of Goods; ſuch as *Tobacco*, *Indico*, and all *Spices*.

Neat is the Weight of a Commodity, after the *Tare* and *Trett* is deducted.

Note. Where Allowance is given for *Trett*, when the *Tare* is taken from the *Groſs*, the Remainder is called *Subtle*; which being divided by 26, gives the *Trett*, becauſe 4 *Pounds* is the 26th Part of 104.

⊕

⊕	*qu.*	℔				
10	0	25	Groſs			
	1	8	Tare			
					s.	
9	3	17	Neat at		13	*per* ⊕
					9	
s. *d.*			£.	5	17	
8|1 10¼			2 *qu.*		6	6
2|2¾			1 *qu.*		3	3
d. 1¼			16 *lb.*		1	10¼
			1 *lb.*			1¼
			£.	6	8	8½

⊕	*qu.*	℔				
8	0	25	Groſs			
	1	8	Tare			
					s.	*d.*
7	3	17	N^t. at		14	5
per ⊕						7
s. *d.*			£.	5	0	11
8|2 0¾			2 *qu.*		7	2½
2|3			1 *qu.*		3	7¼
d. 1½			16 *lb.*		2	0½
			1 *lb.*			1½
			£.	5	13	10¾

⊕	*qu.*	℔				
13	3	27	Groſs			
	2	12	Tare			
				l.	*s.*	*d.*
13	1	15	N^t. at	1	12	3
per ⊕					3	10
l. *s.* *d.*			£.	16	2	6
7|1 12 3				4	16	9
2|4 7¼			1 *qu.*		8	0¾
Sb. 2 3½			8 *lb.*		2	3½
			4 *lb.*		1	1¾
			2 *lb.*			6¾
			1 *lb.*			3¼
			£.	21	11	7

⊕	*qu.*	℔				
14	3	27	Groſs			
	2	12	Tare			
				l.	*s.*	*d.*
14	1	14	N^t. at	1	9	6
per ⊕					4	10
l. *s.* *d.*			£.	14	15	0
7|1 9 6				5	18	0
2|4 2½			1 *qu.*		7	4½
Sb. 2 1¼			8 *lb.*		2	1¼
			4 *lb.*		1	0½
			2 *lb.*			6¼
			1 *lb.*			3
			£.	21	4	3½

C.	qu.	℔		l.	s.	d.
28	3	25	Gross			
1	0	12	Tare			
27	3	13	Neat at		18	*per* C.
					7	10
					9	0
						2
				£. 18	0	
					6	6
			2 *qu.*		9	
			1 *qu.*		4	6
			8 *lb.*		1	$3\frac{1}{4}$
			4 *lb.*			$7\frac{1}{2}$
			1 *lb.*			$1\frac{3}{4}$
				£. 25	1	$6\frac{1}{2}$

s.
7|18
2|2 $6\frac{3}{4}$
Sb. 1 $3\frac{1}{4}$

C.	qu.	℔		l.	s.	d.
37	3	25	Gross			
1	0	12	Tare			
36	3	13	N^t^. at		19	4 *per* C.
					6	10
				£. 9	13	4
						3
				£. 29	0	0
				5	16	0
			2 *qu.*		9	8
			1 *qu.*		4	10
			8 *lb.*		1	$4\frac{1}{2}$
			4 *lb.*			$8\frac{1}{4}$
			1 *qu.*			2
				£. 35	12	$8\frac{3}{4}$

s. d.
7|19 9
2|2 9
Sb. 1 $4\frac{1}{2}$

C.	qu.	℔		l.	s.	d.
368	2	26	Gross			
12	1	15	Tare			
356	1	11	N. at	1	12	4 *per* C.
					6	10
				£. 16	3	4
					5	10
				£. 161	13	4
						3
				£. 485	0	0
				80	16	8
				9	14	0
			1 *qu.*		8	1
			8 *lb.*		2	$3\frac{1}{2}$
			2 *lb.*			$6\frac{3}{4}$
			1 *lb.*			$3\frac{1}{4}$
				£. 576	1	$10\frac{1}{2}$

7|1 12 4
2|4 $7\frac{1}{4}$
Sb. 2 $3\frac{1}{2}$

C.	qu.	℔		l.	s.	d.
507	2	26	Gross			
12	1	15	Tare			
495	1	11	N. at	1	19	6 *per* C.
					5	10
				£. 19	15	0
					9	10
				£. 197	10	0
						4
				£. 790	0	0
				177	15	0
				9	17	6
			1 *qu.*		9	$10\frac{1}{2}$
			8 *lb.*		2	$9\frac{3}{4}$
			2 *lb.*			$8\frac{1}{4}$
			1 *lb.*			4
				£. 978	6	$2\frac{1}{2}$

7|1 19 6
2|4 $7\frac{1}{2}$
Sb. 2 $3\frac{3}{4}$

C.

⊕ qu. ℔
7385 1 8 Grofs
56 1 27 Tare

7328 3 9 N. at 7 s. *per* ⊕
8 10

7|7
2|1
Sb. 0 6

£. 3 10
2 10

£. 35 0
3 10

£. 350 0
7

£. 2450 0
105 0
7 0
2 16

2 *qu.* 3 6
1 *qu.* 1 9
8 *lb.* 6
1 *lb.* ¾

£. 2565 1 9¾

⊕ *qu.* *lb.*
6630 1 8 Grofs
56 1 27 Tare

6573 3 9 Neat at 19 s. *per* ⊕
3 10

7|19
2|2 8½
Sb. 1 4¼

£. 9 10
7 10

£. 95 0
5 10

£. 950 0
6

£. 5700 0
475 0
66 10
2 17

2 *qu.* 9 6
1 *qu.* 4 9
8 *lb.* 1 4¼
1 *lb.* 2

£. 6245 2 9¼

⊕ *qu.* ℔
4297 2 14 Grofs
729 0 6 Tare at 19 ℔ *per* ⊕

⊕3568 2 8 Subtle
137 1 0 Trett

⊕3431 1 8 Neat at 1 l. 2 s. 6 d. *per* ⊕
1 10

⊕ *qu.* ℔
7|4297 2 14
16 *lb.* 613 3 22
2 *lb.* 76 2 27
1 *lb.* 38 1 13
19 ⊕729 0 6

£. 11 5 0
3 10

£. 112 10 0
4 10

£. 1125 0 0
3

£. 3375 0 0
450 0 0
33 15 0
1 2 6

1 *qu.* 5 7½
7 *lb.* 1 4¾
1 *lb.* 2¼

£. 3860 4 8½

⊕ *qu.* ℔
137 1 0
26|3568 2 8
26

96
78

188
182

6
4

126
26

98

	C	qu.	℔				
	3829	3	30	Grofs			
	410	1	11¼	Tare at 12 ℔ *per* C			
C	3419	2	8¾	Subtle			
	131	2	2¼	Trett	*l.*	*s.*	*d.*
C	3288	0	6½	Neat at	2	4	8¼ *per* C

	l.	*s.*	*d.*
		8	10
£.	22	6	10½
		8	10
£.	223	8	9
		2	10
£.	2234	7	6
			3
£.	6703	2	6
	446	17	6
	178	15	0
	17	17	6
4 *lb.*		1	7
2 *lb.*			9½
½ *lb.*			2¼
£.	7346	15	0¾

	C	qu.	℔
7	3829	3	20
16 *lb.*	547	0	15
8 *lb.*	273	2	7½
4 *lb.*	136	3	3¾
C	410	1	11¼

	l.	*s.*	*d.*
7	2	4	8¼
16 *lb.*		6	4½
4 *lb.*		1	7

	C	qu.	℔
	131	2	2¼
26	3419	2	8¾
	26		
	81		
	78		
	39		
	26		
	13		
	4		
	54		
	52		
	2		
	28		
	64		
	52		
	12		
	4		
	48		
	26		
	22		

In *Example* 1. The Price of the *Quarters*, and the Price of 16 *lb.* is obtained as afore; then the Price of 16 *lb.* divided by 8, gives the Price of 2 *lb.* which divided by 2, gives the Price of 1 *lb.*

In *Example* 2, 3, 4, and 5. The Price of 1 C is divided by 7, for the Price of 16 *lb.* which divided by 2, gives the Price of 8 *lb.* &c.

In *Example* 6, and 7. The *Grofs Weight* is divided by 7, for the *Tare* of 16 *lb.* &c. and the *Subtle Weight* by 26, for the whole *Trett*, as in the Examples.

To render this Treatife compleat, I have added fome further *Examples* in *Weight* and *Meafure*.

Ton

Ton ⊕ qu. lb.		*l.*	*s.*	*d.*
57 19 3 27	at	4	16	9
per Ton.			7	10
		£. 48	7	6
4|19 4				5
*Sh.*4 10		£. 241	17	6
		33	17	3
10 ⊕		2	8	4½
5 ⊕		1	4	2¼
4 ⊕			19	4
2 *qrs.*			2	5
1 *qr.*			1	2½
16 *lb.*				8¼
8 *lb.*				4
2 *lb.*				1
1 *lb.*				½
		£. 280	11	5

Ton ⊕ qr. lb.		*l.*	*s.*	*d.*
65 19 3 27	at	5	18	4
per Ton.			5	10
		£. 59	3	4
4|1 3 8				6
Sh. 5 11		£. 355	0	0
		29	11	8
10 ⊕		2	19	2
5 ⊕		1	9	7
4 ⊕		1	3	8
2 *qrs.*			2	11½
1 *qr.*			1	5¾
16 *lb.*				10
8 *lb.*				5
2 *lb.*				1¼
1 *lb.*				½
		£. 390	9	11

Ton ⊕ qr. lb.		*l.*	*s.*	*d.*
154 17 1 25	at	5	18	7¼
per Ton.			4	10
		£. 59	6	0½
2|11 10¼			5	10
*Sh.*5 11		£. 593	0	5
		296	10	2½
		23	14	5
10 ⊕		2	19	3½
5 ⊕		1	9	7¾
2 ⊕			11	10¼
1 *qu.*			1	5¾
16 *lb.*				10
8 *lb.*				5
1 *lb.*				½
		£. 918	8	7¼

Ton ⊕ qr. lb.		*l.*	*s.*	*d.*
256 17 1 25	at	6	11	9
per Ton.			6	10
		£. 65	17	6
2|13 2			5	10
*Sh.*6 7		£. 658	15	0
				2
		£. 1317	10	0
		329	7	6
		39	10	6
10 ⊕		3	5	10½
5 ⊕		1	12	11¼
2 ⊕			13	2
1 *qr.*			1	7¾
16 *lb.*				11¼
8 *lb.*				5½
1 *lb.*				½
		£. 1692	3	0¼

In *Example* 1. 20 ⊕ being a *Ton*, I divide the Price of 1 *Ton* by 2, it gives the Price of 10 ⊕. The Price of 10 ⊕ divided by 2, gives the Price of 5 ⊕. The Price of 1 *Ton* divided by 5, gives the Price of 4 ⊕. The Price of 4 ⊕ divided by 4, gives 4*s.* 10*d.* for the Price of 1 ⊕, from whence the *Quarters* and *Pounds* are obtained as afore.

In

In *Example* 2. The Price of 10 ⊕ is divided by 5, for the Price of 2 ⊕, and the Price of 2 ⊕ divided by 2, gives 5*s.* 11*d.* for the Price of 1 ⊕, from whence the *Quarters* and *Pounds* are obtained.

oz. dwt. gr.		*s.*	*d.*
37 19 23 at		5	9½
per Ounce.		7	10
	£. 2	17	11
			3
	£. 8	13	9
	2	0	6½
10 *dwt.* - - - -		2	10¾
5 *dwt.* - - - -		1	5¼
4 *dwt.* - - - -		1	1¾
12 *gr.* - - - - - -			1½
6 *gr.* - - - - - - -			¾
4 *gr.* - - - - - - -			½
	£. 11	0	0

oz. dwt. gr.		*s.*	*d.*
55 19 23 at		6	8
per Ounce.		5	10
	£. 3	6	8
			5
	£. 16	13	4
	1	13	4
10 *dwt.* - - - -		3	4
5 *dwt.* - - - -		1	8
4 *dwt.* - - - -		1	4
12 *gr.* - - - - - -			2
6 *gr.* - - - - - -			1
4 *gr.* - - - - - - -			½
	£. 18	13	3½

oz. dwt. gr.		*s.*	*d.*
259 11 3 at		6	8¾
per Ounce.		9	10
	£. 3	7	3½
		5	10
	£. 33	12	11
			2
	£. 67	5	10
	16	16	5½
	3	0	6¾
10 *dwt.* - - - -		3	4¼
1 *dwt.* - - - - - - -			4
3 *gr.* - - - - - - - -			½
	£. 87	6	7

oz. dwt. gr.		*s.*	*d.*
354 11 3 at		8	9
per Ounce.		4	10
	£. 4	7	6
		5	10
	£. 43	15	0
			3
	£. 131	5	0
	21	17	6
	1	15	0
10 *dwt.* - - - -		4	4½
1 *dwt.* - - - - - - -			5¼
3 *gr.* - - - - - - - -			½
	£. 155	2	4¼

In

In *Example* 1. 20 *Pennyweight* being an *Ounce*, I divide the Price of 1 *Ounce* by 2, it gives the Price of 10 *Pennyweight*; the Price of 10 *Pennyweight* by 2, gives the Price of 5 *Pennyweight*; the Price of 1 *Ounce* divided by 5, gives the Price of 4 *Pennyweight*; the Price of 4 *Pennyweight* divided by 8, gives the Price of 12 *Grains*; the Price of 12 *Grains* by 2, gives the Price of 6 *Grains*, and the Price of 12 *Grains* by 3, gives the Price of 4 *Grains*; the Price of 1 *Grain* being of no Value, is left out.

In *Example* 2. The Price of 10 *Pennyweight* is divided by 10, for the Price of 1 *Pennyweight*, and the Price of 1 *Pennyweight* divided by 8, for the Price of 3 *Grains*.

lb. *oz.* *dwt.* *gr.*		*l.*	*s.*	*d.*
459 11 5 7	at	5	16	8
per Pound.			9	10
		£. 58	6	8
			5	10
		£. 583	6	8
				4
		£. 2333	6	8
		291	13	4
		52	10	0
6 *oz.*		2	18	4
3 *oz.*		1	9	2
2 *oz.*			19	5¼
4 *dwt.*			1	11¼
1 *dwt.*				5¾
6 *gr.*				1¼
		£. 2682	19	5½

lb. *oz.* *dwt.* *gr.*		*l.*	*s.*	*d.*
572 11 5 7	at	7	18	9
per Pound.			2	10
		£. 79	7	6
			7	10
		£. 793	15	0
				5
		£. 3968	15	0
		555	12	6
		15	17	6
6 *oz.*		3	19	4½
3 *oz.*		1	19	8¼
2 *oz.*		1	6	5½
4 *dwt.*			2	7¾
1 *dwt.*				7¾
6 *gr.*				1¾
1 *gr.*				¼
		£. 4547	13	11¾

lb.

lb.	*oz.*	*dwt.*	*gr.*		*l.*	*s.*	*d.*
653	9	3	5	at	15	16	$8\frac{3}{4}$
per Pound.						3	10
					£. 158	7	$3\frac{1}{2}$
						5	10
					£. 1583	12	11
							6
					£. 9501	17	6
					791	16	$5\frac{1}{2}$
					47	10	$2\frac{1}{4}$
6 *oz.*					7	18	$4\frac{1}{4}$
2 *oz.*					2	12	$9\frac{1}{4}$
1 *oz.*					1	6	$4\frac{1}{2}$
2 *dwt.*						2	$7\frac{1}{2}$
1 *dwt.*						1	$3\frac{3}{4}$
4 *gr.*							$2\frac{1}{2}$
1 *gr.*							$\frac{1}{2}$
					£. 10353	5	10

lb.	*oz.*	*dwt.*	*gr.*		*l.*	*s.*	*d.*
278	9	3	5	at	18	19	7
per Pound.						8	10
					£. 189	15	10
						7	10
					£. 1897	18	4
							2
					£. 3795	16	8
					1328	10	10
					151	16	8
6 *oz.*					9	9	$9\frac{1}{2}$
2 *oz.*					3	3	3
1 *oz.*					1	11	$7\frac{1}{2}$
2 *dwt.*						3	$1\frac{3}{4}$
1 *dwt.*						1	$6\frac{3}{4}$
4 *gr.*							3
1 *gr.*							$\frac{3}{4}$
					£. 5290	13	$10\frac{1}{4}$

In *Example* 1 and 2. 12 *Ounces* being a *Pound*, I divide the Price of 1 *Pound* by 2, it gives the Price of 6 *Ounces*. The Price of 6 *Ounces* divided by 2, gives the Price of 3 *Ounces*, and the Price of 6 *Ounces* divided by 3, gives the Price of 2 *Ounces*, the Price of 2 *Ounces* divided by 10, gives the Price of 4 *Pennyweight*, &c.

Tun	*hhd.*	*ga.*	*qt.*		*l.*	*s.*	*d.*
652	3	62	3	at	5	17	8
per Tun.						2	10
					£. 58	16	8
						5	10
					£. 588	6	8
							6
					£. 3530	0	0
					294	3	4
					11	15	4
2 *hhds*					2	18	10
1 *hhd*					1	9	5
21 *gal.*						9	$9\frac{1}{2}$
21 *gal.*						9	$9\frac{1}{2}$
7 *gal.*						3	3
7 *gal.*						3	3
3 *gal.*						1	$4\frac{3}{4}$
3 *gal.*						1	$4\frac{3}{4}$
3 *qts.*							4
					£. 3841	16	$1\frac{1}{2}$

Tun	*hhd.*	*ga.*	*qt.*		*l.*	*s.*	*d.*
798	3	62	3	at	7	18	9
per Tun.						8	10
					£. 79	7	6
						9	10
					£. 793	15	0
							7
					£. 5556	5	0
					714	7	6
					63	10	0
2 *hhds*					3	19	$4\frac{1}{2}$
1 *hhd*					1	19	$8\frac{1}{4}$
21 *gal.*						13	$2\frac{3}{4}$
21 *gal.*						13	$2\frac{3}{4}$
7 *gal.*						4	$4\frac{3}{4}$
7 *gal.*						4	$4\frac{3}{4}$
3 *gal.*						1	$10\frac{1}{2}$
3 *gal.*						1	$10\frac{1}{2}$
3 *qts.*							$5\frac{1}{2}$
					£. 6342	1	$0\frac{1}{4}$

Tn.	hhd.	ga.	qu.	pe.	*l.*	
796	1	11	2	1	at 7 *per* Tun.	

	6	10
	£. 70	
3|1 15 Sh. 11 8	9	10
	£. 700	
	7	
	£. 4900	
	630	
	42	
1 Hogshead	1	15
7 Gallons	3	10½
3 Gallons	1	8
1 Gallon		6½
2 Quarts		3¼
1 Pint		¾
£. 5574	1	5

Tn.	hhd.	ga.	qu.	pe.	*l.*	*s.*	
875	1	11	2	1	at 7	16	*per* Tun.

	5	10
	£. 78	0
3|1 19 Sb. 13	7	10
	£. 780	0
		8
	£. 6240	0
	546	0
	39	0
1 Hogshead	1	19
7 Gallons	4	4
3 Gallons	1	10¼
1 Gallon		7¼
2 Quarts		3½
1 Pint		0¾
£. 6827	6	1¼

In *Example* 1. 4 *Hogsheads* being a *Tun*, I divide the Price of a *Tun* by 2, it gives the Price of 2 *Hogsheads*, and the Price of 2 *Hogsheads* divided by 2, gives the Price of 1 *Hogshead*; then because 63 *Gallons* makes 1 *Hogshead*, I divide the Price of 1 *Hogshead* by 3, it gives the Price of 21 *Gallons*, and the Price of 21 *Gallons* by 3, it gives the Price of 7 *Gallons*, and also the Price of 21 *Gallons* by 7, it gives the Price of 3 *Gallons*, then the Price of 3 *Gallons* by 4, it gives the Price of 3 *Quarts*.

In the 2d *Example*, I divide the Price of a *Tun* by 4, it gives the Price of 1 *Hogshead*, then the Price of 1 *Hogshead* by 3, it gives 11 *s.* 8 *d.* for the Price of 21 *Gallons*, then the Price of 21 *Gallons* divided by 3, gives the Price of 7 *Gallons*, &c.

qu. bu. pe.		*s.*	*d.*
227 5 1 at		13	6 *per* Quarter.
		7	10
	£. 6	15	0
		5	10
	£. 67	10	0
			2
	£. 135	0	0
	33	15	0
	4	14	6
4 Bushels		6	9
1 Bushel		1	8¼
1 Peck			5
	£. 173	18	4¼

qu. bu. pe.	*l.*	*s.*	*d.*
354 5 1 at	1	8	9 *per* Quarter.
		4	10
	£. 14	7	6
		5	10
	£. 143	15	0
			3
	£. 431	5	0
	71	17	6
	5	15	0
4 Bushels		14	4½
1 Bushel		3	7
1 Peck			10¾
	£. 509	16	4¼

Last qu. bu. pe.	*l.*	*s.*	
2756 9 7 3 at	3	19 *per* Last.	
	6	10	
	£. 39	10	
	5	10	
	£. 395	0	
	7	10	
	£. 3950	0	
		2	
	£. 7900	0	
	2765	0	
	197	10	
	23	14	
5 Quarters	1	19	6
2 Quarters		15	9½
2 Quarters		15	9½
4 Bushels		3	11¼
2 Bushels		1	11½
1 Bushel			11¾
2 Pecks			5¾
1 Peck			2¾
	£. 10890	2	8

Last qu. bu. pe.	*l.*	*s.*	*d.*
4279 9 7 3 at	4	12	6 *per* Last.
		9	10
	£. 46	5	0
		7	10
	£. 462	10	0
		2	10
	£. 4625	0	0
			4
	£. 18500	0	0
	925	0	0
	323	15	0
	41	12	6
5 Quarters	2	6	3
2 Quarters		18	6
2 Quarters		18	6
4 Bushels		4	7½
2 Bushels		2	3¾
1 Bushel		1	1¾
2 Pecks			6¾
1 Peck			3¼
	£. 19794	19	8

In

In *Example* 1. A *Quarter* being 8 *Bushels*, I divide the Price of one *Quarter* by 2, it gives the Price of 4 *Bushels*, then the Price of 4 *Bushels* by 4, it gives the Price of 1 *Bushel*, then the Price of 1 *Bushel* by 4, it gives the Price of 1 *Peck*.

In *Example* 2. Because 10 *Quarters* is a *Last*, I divide the Price of 1 *Last* by 2, it gives the Price of 5 *Quarters*, and the Price of a *Last* by 5, it gives the Price of 2 *Quarters*, then I divide the Price of 2 *Quarters* by 4, it gives the Price of 4 *Bushels*, &c.

Thus have I gone through what I think is sufficient to render a Person a good Accomptant; and have established it upon such plain and easy Principles, that Persons of the meanest Capacities may attain it, and be enabled to give the *Amount* of any *Quantity* at any Price. I shall now proceed to account for *Commissions*, *Brokage*, *Purchasing of publick Stocks*, *Foreign Exchanges*, and *Interest* of Money, and establish the same upon the same Principles, with as little Variation as possible.

Commission is an Allowance given to a *Factor* or *Correspondent*, for selling of Goods put into his Hands by his *Employer*, and is generally at a certain Rate *per Cent.* according to the Custom of Places, or rather Agreement: To Account for which, observe this Rule.

RULE.

Multiply the Sum of Money by the Rate *per Cent*; and divide by 100.

What is the *Commission* of 256*l.* at 3 *per Cent.*

	256	
	3	
£.	7|68	
	20	
Sh.	13|60	
	12	
d.	7|20	

What is the *Commission* of 487*l.* 18*s.* at 2¼ *perC.*

	487	18	
	2		
£.	975	16	
¼ -	121	19	6
£.	10|97	15	6
	20		
Sh.	19|15		
	12		
d.	1|86		
	4		
f.	3|44		

At 2½ *per Cent.* what is the *Com.* of 3456*l.* 19*s.* 10*d.*

	3456	19	10
			2
£.	6913	19	8
½ - - - -	1728	9	11
£.	86|42	9	7
	20		
Sh.	8|49		
	12		
d.	5|95		
	4		
f.	3|80		

At 2¾ *per Cent.* what is the *Com.* of 7528*l.* 14*s.* 6*d.*¾

	7528	14	6¾
			2
£.	15057	9	1½
½ - - - -	3764	7	3¾
¼ - - - -	1882	3	7½
£.	207|04	0	0¼
	20		
Sh.	0|80		
	12		
d.	9|60		
	4		
f.	2|41		

In *Example* 1. I multiply the Sum of Money by 3, then cut off 2 Figures in the *Pounds*, which is dividing them by 100, you have 7 *Pounds* and 68 Parts of 100 for the *Commission*, the Value of the 68 Parts cut off, is found by multiplying them by 20, and cuting off 2 Figures as afore, you have 13 *Shillings* and 60 Parts, then multiplying the 60 Parts by 12, and cuting off 2 Figures, you have 7 *Pence*

7 *Pence* and 20 Parts; so that the *Commission* of 256 *Pounds*, is 7*l.* 13*s.* 7*d.* as in the *Example.*

In *Example* 2. The Sum of Money is multiplied by 2, and for the ¼ I divide the given Sum of Money by 4; these 2 Sums added together, and 2 Figures off in the *Pounds*, gives 10 *Pounds* and 97 Parts; these Parts multiplied by 20, adding 15 *Shillings*, and cuting off 2 Figures as afore, gives 19 *Shillings* and 15 Parts; these Parts multiplied by 12, adding 6 *Pence*, and cuting off 2 Figures, gives 1 *Penny* and 86 Parts; these Parts multiplied by 4, cuting off 2 Figures, gives 3 *Farthings* and 44 Parts, so that the *Commission* of 487*l.* 18*s.* at 2¼ *per Cent.* is 10*l.* 19*s.* 1*d.* ¾ as in the *Example.*

In *Example* 3. The given Sum is multiplied by 2, and for the ½ *per Cent.* I divide the given Sum by 2; these 2 Sums added together, and 2 Figures cut off in the *Pounds*, gives 86 *Pounds* and 42 Parts; the Value of which Parts is found as afore.

In *Example* 4. The given Sum is multiplied by 2, and for ½ *per Cent.* I divide the given Sum by 2, as afore, and for ¼ *per Cent.* I divide the Sum for ½ *per Cent.* by 2; these 3 Sums added together, and 2 Figures cut off in the *Pounds*, gives 207 *Pounds* and 04 Parts; the Value of which Parts is found as afore.

BROKAGE

Is Money paid to *Brokers* for helping *Merchants*, or *Factors* to Persons, to buy or sell them Goods.

At ½ *per Cent.* what is the *Brokage* of 567*l.* 12*s.*

½ - - - - - -	£. 2|83	16	
	20		
	Sh. 16|76		
	12		
	d. 9|12		

At ½ *per Cent.* what is the *Brokage* of 248*l.* 12*s.* 10*d*

½ - - - -	£. 1|24	6	5
	20		
	Sh. 4|86		
	12		
	d. 10|37		
	4		
	f. 1|48		

At ¾ *per Cent.* what is the *Brokage* of 675*l.* 11*s.* 9*d.*

½ - - -	£. 337	15	10½
¼ - - - -	168	17	11¼
	5|06	13	9¼
	20		
Sh.	1|33		
	12		
d.	4|05		

At ¾ *per Cent.* what is the *Brokage* of 345*l.* 12*s.* 10*d.* ¾

½ - - - -	£. 172	16	5¼
¼ - - - - - -	86	8	2½
	£. 2|59	4	7¾
	20		
Sh.	11|84		
	12		
d.	10|15		

The ſame Method is purſued in theſe *Examples*, as afore in the *Commiſſions*; and therefore I think it needleſs to ſay any thing further about them.

PURCHASES.

In purchaſing of *Stocks*, I multiply the Sum to be *purchaſed* by the Exceſs above 100, and the Produce of that added to the given Sum, gives the *Purchaſe* thereof, as in the following *Examples*.

At 119 *per C^t^.* what is the *Purchaſe* of 2756*l.* Bank Stock.

	9 10		
	£. 27560		
	24804		
	£. 523|64		
	20		
Sh.	12|80		
	12		
d.	9|60		
	4		
f.	2|40		
£. 2756			
523	12	9½	
£. 3279	12	9½	

At 108⅜ *per C.* what is the *Purchaſe* of 3287*l.* 14*s.* S. Sea Stock.

	8		
	£. 26301	12	
¼ - - - - - - -	821	18	6
⅛ - - - - - - - -	410	19	3
	£. 275|34	9	9
	20		
Sh.	6|89		
	12		
d.	10|77		
	4		
f.	3|08		
£. 3287	14		
275	6	10¾	
£. 3563	0	10¾	

At

At 124$\frac{3}{4}$ *per Cent.* what is the *Purchase* of 758*l.* 17*s.* 10*d.* *India Stock.*

		4	10
	£. 7588	18	4
			2
	£. 15177	16	8
	3035	11	4
$\frac{4}{8}$	379	8	11
$\frac{1}{8}$	94	17	2$\frac{1}{4}$
	£. 186|87	14	1$\frac{1}{4}$
	20		
	Sh. 17|54		
	12		
	d. 6|49		
	4		
	f. 1|99		

£.	758	17	10
	186	17	6$\frac{1}{4}$
£.	945	15	4$\frac{1}{2}$

At 105$\frac{3}{4}$ *per Cent.* what is the *Purchase* of 845*l.* 19*s.* 11*d.*$\frac{3}{4}$ *Mill. Bank.*

			5
	£. 4229	19	10$\frac{3}{4}$
$\frac{1}{2}$	422	19	11$\frac{3}{4}$
$\frac{1}{4}$	211	9	11$\frac{3}{4}$
	£. 48|64	9	10$\frac{1}{4}$
	20		
	Sh. 12|89		
	12		
	d. 10|78		
	4		
	f. 3|13		

£.	845	19	11$\frac{3}{4}$
	48	12	10$\frac{3}{4}$
£.	894	12	10$\frac{1}{2}$

To Account for the *Interest* of Money, I multiply the given Sum by the Rate *per Cent.* and divide by 100, it gives the Interest of the Money for *one Year*, then the *Interest* for the Time required is obtained, as in the *Examples* following.

and 3 for the [illegible] — 0 .. 10 .. 4

At

At 5 *per Cent. per Annum* what is the *Interest* of 69 *l.* forborn 3 *m.* 18 *d.*

	l.
	69
	5
£.	3|45
	20
Sh.	9|00

m.	*d.*		*l.*	*s.*	*d.*	
3	18	at	3	9		*per Ann.*
2 Months			0	11	6	
1 Month				5	9	
15 Days				2	$10\frac{1}{2}$	
3 Days					$6\frac{1}{4}$	
		£.	1	0	$8\frac{1}{4}$	

At $5\frac{1}{2}$ *per Cent. per Ann.* what is the *Interest* of 78 *l.* 11 *s.* forborn 5 *m.* 22 *Days.*

	l.	*s.*	
	78	11	
		5	
£.	392	15	
$\frac{1}{2}$	19	12	9
£.	4|12	7	9
	20		
Sh.	2|47		
	12		
d.	5|73		
	4		
f.	2|92		

m.	*d.*		*l.*	*s.*	*d.*
5	22	at	4	2	$5\frac{1}{2}$ *per Annum.*
4 Months			1	7	$5\frac{1}{4}$
1 Month				6	$10\frac{1}{4}$
15 Days				3	5
6 Days				1	$4\frac{1}{4}$
1 Day					$2\frac{1}{2}$
		£.	1	19	$3\frac{1}{4}$

At

At 6 *per Cent. per Annum* what is the *Interest* of 562 *l.* 14 *s.* 5 *d.* forborn 7 *mon.* 25 *Days.*

	l.	*s.*	*d.*
	562	14	5
			6
£.	33|76	6	6
	20		
Sh.	15|26		
	12		
d.	3|18		

m. *d.*	*l.*	*s.*	*d.*
7 25 at	33	15	3 *per Annum.*
6 Mon.	16	17	7½
1 Mon.	2	16	3¼
15 Days	1	8	1½
10 Days		18	9
£.	22	0	9¼

At 6½ *per Cent. per Ann.* what is the *Interest* of 698 *l.* 18 *s.* 10 *d.*½ forborn 3 *Years.*

	l.	*s.*	*d.*
	698	18	10½
			6
£.	41|93	13	3
½	349	9	5¼
£.	45|43	2	8¼
	20		
Sh.	8|62		
	12		
d.	7|52		
	4		
f.	2|09		

	l.	*s.*	*d.*
3 *Years* at	45	8	7½
per Ann.			3
£.	136	5	10½

L. At

At 7 *per Cent. per Annum*, what is the *Interest* of 4278*l.* forborn 4 *Years*, 10 *Months*.

	l.
	4278
	7
£.	299|46
	20
Sh.	9|20
	12
d.	2|40
	4
f.	1|60

ye. m.	*l.*	*s.*	*d.*
4 10 at	299	9	$2\frac{1}{4}$
per Ann.			4
£.	1197	16	9
6 Mon. -	149	14	7
4 Mon. - -	99	16	$4\frac{1}{4}$
£.	1447	7	$8\frac{1}{4}$

At $7\frac{1}{2}$ *per Cent. per Ann.* what is the *Interest* of 5284*l.* 16*s.* forborn 5 *Years*, 11 *Mon.* 29 *Da.*

		l.	*s.*
		5284	16
			7
	£.	36993	12
$\frac{1}{2}$	- - - - - - - -	2642	8
$\frac{1}{4}$	- - - - - - - -	1321	4
	£.	409|57	4
		20	
	Sh.	11|44	
		12	
	d.	5|28	
		4	
	f.	1|12	

ye. m. d.	*l.*	*s.*	*d.*
5 11 29 at	409	11	$5\frac{1}{4}$
per Ann.			5
£.	2047	17	$2\frac{1}{4}$
6 Mon. - -	204	15	$8\frac{1}{2}$
3 Mon. - -	102	7	$10\frac{1}{4}$
2 Mon. - - -	68	5	$2\frac{1}{4}$
15 Days - - -	17	1	$3\frac{1}{2}$
10 Days - - -	11	7	$6\frac{1}{4}$
3 Days - - - -	3	8	3
1 Day - - - -	1	2	9
£.	2456	5	$9\frac{1}{2}$

Though this Method of computing *Interest*, be not ſtrictly and properly exact, yet it may very well ſerve for common Computations, varying but little from Truth. A more exact Method ſhall be ſhewn

shewn in its proper Place, when I come to treat of those Parts of *Arithmetic* which cannot be brought under this general Way of accompting.

To Accompt for foreign *Exchanges*, it would be necessary to have a true Account at all Times of the just Values of *foreign Coins*, because the *Par of Exchange* rises and falls according as Money is plenty or scarce, or according to the Time allowed for Payment of the Money in *Exchange*. The which is *weekly* published, and to be seen at most of the *Coffee-houses* about the *Royal Exchange*; and because I have often found the same as generally published very unintelligible to many Persons, I have transcribed one with some Additions to render the same more intelligible.

1 £. Ster. at	*Amsterdam* is	34 11	Flemish
Ditto - - -	Ditto at Sight	34 8	
Ditto - - -	*Rotterdam* - -	35 1	
Ditto - - -	*Antwerp* - - -	35 9	
Ditto - - -	*Hamburgh* - -	33 6	
$31\frac{7}{8}$ *Pence*	*Paris* at 1 Days date		1 Crown of 3 Livres
$31\frac{1}{2}$ - - - -	*Bourdeaux* at $1\frac{1}{2}$ Usance		Ditto
$41\frac{3}{4}$ - - - -	*Cadiz* - - - - - - - - - -		1 Peso of 8 Reals
$41\frac{7}{8}$ - - - -	*Madrid* - - - - - - - -		1 Peso of 10 Reals
$50\frac{3}{4}$ - - - -	*Leghorn* - - - - - - - -		1 Peso of 6 Livres
$53\frac{1}{2}$ - - - -	*Genoua* - - - - - - - -		1 Peso of 5 Livres
$48\frac{1}{2}$ - - - -	*Venice* - - - - - - - - - -		1 Bank Ducat
5 *s.* 5 *d.* $\frac{5}{8}$	*Lisbon* - - - - - - -		1000 Reas
5 *s.* 5 *d.* $\frac{1}{2}$	*Porto* - - - - - - - - -		1000 Reas
	Dublin - - - - - - - - -		$11\frac{1}{8}$ *per Cent.*

d.
759 *Dollars* at $55\frac{1}{4}$ *per Dollar.*

	12 |	$55\frac{1}{4}$	
Sh.		4	$7\frac{1}{4}$
		9	10
£.	2	6	$0\frac{1}{2}$
		5	10
£.	23	0	5
			7
£.	161	2	11
	11	10	$2\frac{1}{2}$
	2	1	$5\frac{1}{4}$
£.	174	14	$6\frac{3}{4}$

148 *Dollars* at $52\frac{3}{4}$ *per Dollar.*

	12 |	$52\frac{3}{4}$	
Sh.		4	$4\frac{3}{4}$
		8	10
£.	2	3	$11\frac{1}{2}$
		4	10
£.	21	19	7
	8	15	10
	1	15	2
£.	32	10	7

doll. *rea.* *d.*
269 7 at $53\frac{1}{8}$ *per Dollar.*

	12 |	$53\frac{1}{8}$	
Sh.		4	$5\frac{1}{8}$
		9	10
£.	2	4	$3\frac{2}{8}$
		6	10
£.	22	2	$8\frac{4}{8}$
			2
£.	44	5	5
	13	5	$7\frac{4}{8}$
	1	19	$10\frac{1}{8}$
4 Reals - - - - - - - -		2	$2\frac{4}{8}$
2 - - - - - - - - - - - -		1	$1\frac{2}{8}$
1 - - - - - - - - - - - - - -			$6\frac{5}{8}$
£.	59	14	9

Note, 8 *Reals* is a *Dollar.*

doll. *rea.* *d.*
387 3 at $54\frac{3}{8}$ *per Dollar.*

	12 |	$54\frac{3}{8}$	
Sh.		4	$6\frac{3}{8}$
		7	10
£.	2	5	$3\frac{6}{8}$
		8	10
£.	22	13	$1\frac{4}{8}$
			3
£.	67	19	$4\frac{4}{8}$
	18	2	6
	1	11	$8\frac{5}{8}$
2 *Reals* - - - - - - - -		1	$1\frac{4}{8}$
1 - - - - - - - - - - - - - -			$6\frac{6}{8}$
£.	87	15	$3\frac{1}{8}$

456 *Ducats*

d.
456 *Ducats* at 51 5/8 *per Ducat.*

	12|51		5/8
Sh.	4		3 5/8
	6	10	
£. 2	3		0 2/8
	5	10	
£. 21	10		2 4/8
		4	
£. 86	0		10
10	15		1 2/8
1	5		9 6/8
£. 98	1		9

d.
573 *Ducats* at 56 7/8 *per Ducat.*

	12|56		7/8
Sh.	4		8 7/8
	3	10	
£. 2	7		4 6/8
	7	10	
£. 23	13		11 4/8
		5	
£. 118	9		9 4/8
16	11		9 2/8
	14		2 5/8
£. 135	15		9 3/8

mil rea.	*rea.*		*s.*	*d.*
574	396	at	5	5 3/8
per Mil Rea.			4	10
	£.	2	14	5 6/8
			7	10
	£.	27	4	9 4/8
				5
	£.	136	3	11 4/8
		19	1	4 2/8
Reas		1	1	9 4/8
250	. . . . . .			4 2/8
100	. . . . . .			6 4/8
20	. . . . . .			1 2/8
20	. . . . . .			1 2/8
5	. . . . . .			2/8
395	£.	156	9	2 6/8

Note, 1000 *Reas* is a *Mil* Rea.

mil rea.	*rea.*		*s.*	*d.*
649	629	at	5	7 1/8
per Mil Rea.			9	10
	£.	2	15	11 4/8
			4	10
	£.	27	19	4 4/8
				6
	£.	167	16	3
		11	3	9
Reas.		2	10	4 1/8
500	. . . .		2	9 1/8
100	. . . . . .			6 4/8
20	. . . . . .			1 2/8
5	. . . . . .			2/8
4	. . . . . .			2/8
629	£.	181	13	9 7/8

756*l.* 15*s.* 9*d.* *Flemish*, at 34*s.* 6*d.* *Flem.* *per* £. *Sterl.*

```
s. d.        l.   s.  d.
34 6        756  15   9
12           20
---         -----
414        15135
              12   l.
414)181629(438
     297
      20  s.
414)5940(14
     144
      12  d.
414)1728(4
      72
```

837*l.* 17*s.* 5*d.* *Flemish*, at 36*s.* 8*d.* *Flem.* *per* £. *Sterl.*

```
s. d.        l.   s.  d.
36 8        837  17   5
12           20
---         -----
440        16757
              12   l.
440)201089(457
           9
          20
         180
          12  d.
440)2160(4
     400
       4
440)1600(3
     280
```

The preceeding *Examples* are so plain as to need nothing to be said thereupon; and therefore I shall now proceed to shew how the *amount* of any *Quantity* at any *Price*, may be obtained by another Method, which in the Language of *Arithmeticians* is generally called *Practice*, which requires the following *Tables* to be first perfectly learned.

The even Parts of a *Pound*.

10*s.*		$\frac{1}{2}$
6	8	$\frac{1}{3}$
5		$\frac{1}{4}$
4		$\frac{1}{5}$
3	4	$\frac{1}{6}$
2	6	$\frac{1}{8}$
2		$\frac{1}{10}$
1	8	$\frac{1}{12}$
1		$\frac{1}{20}$

The even Parts of a *Shilling*.

6 *d.*		$\frac{1}{2}$
4		$\frac{1}{3}$
3		$\frac{1}{4}$
2		$\frac{1}{6}$
1	$\frac{1}{2}$	$\frac{1}{8}$
1		$\frac{1}{12}$

A General Rule.

Divide the *Quantity* by the even Parts of a *Penny*, *Shilling*, or *Pound*; the *Quotient* will be the Answer to your Question in *Pence*, *Shillings*, or *Pounds*.

2479 *Ounces*, at $\frac{1}{8}$ of a *penny per Ounce.*

		2479
$\frac{1}{8}$	$\frac{1}{8}$	*d.* 309 $\frac{7}{8}$
		Sh. 25 9
		£. 1 5 9 $\frac{7}{8}$.

3257 *Ounces*, at $\frac{1}{4}$ of a *penny per Ounce.*

		3257
$\frac{1}{4}$	$\frac{1}{4}$	*d.* 814 $\frac{1}{4}$
		Sh. 67 10
		£. 3 7 10 $\frac{1}{4}$

6787 *Pounds*, at $\frac{3}{8}$ of a *Penny per Pound.*

		6787
$\frac{2}{8}$	$\frac{1}{4}$	*d.* 1696 $\frac{3}{4}$
$\frac{1}{8}$	$\frac{1}{2}$	848 $\frac{3}{4}$
		d. 2545
		Sh. 212 1
		£. 10 12 1

5324 *Pounds*, at $\frac{1}{2}$ of a *Penny per Pound.*

		5324
$\frac{1}{2}$	$\frac{1}{2}$	*d.* 2662
		Sh. 221 10
		£. 11 1 10

5872 *Grains*, at $\frac{5}{8}$ of a *Penny per Grain.*

		5872
$\frac{4}{8}$	$\frac{1}{2}$	*d.* 2936
$\frac{1}{8}$	$\frac{1}{4}$	734
		d. 3670
		Sh. 305 10
		£. 15 5 10

3296 *Grains*, at $\frac{3}{4}$ of a *Penny per Grain.*

		3296
$\frac{1}{2}$	$\frac{1}{2}$	*d.* 1648
$\frac{1}{4}$	$\frac{1}{2}$	824
		d. 2472
		Sh. 206
		£. 10 6

4522 *Drachms* at $\frac{7}{8}$ of a *Penny per Drachm*.

	4522	
$\frac{1}{2}$	*d.* 2261	
$\frac{1}{2}$	1130 $\frac{1}{2}$	
$\frac{1}{2}$	565 $\frac{1}{4}$	
	d. 3956 $\frac{3}{4}$	
	Sh. 32|9	8
	£. 16	9 8 $\frac{3}{4}$

In the first of these *Examples*, I divide the Quantity by 8, the Quotient is 309 $\frac{3}{8}$ *Pence*, which reduced into *Pounds*, gives 1 *l.* 5 *s.* 9 *d.* $\frac{3}{8}$. for the Price of 2479 *Ounces*, at $\frac{1}{8}$ of a *Penny per Ounce*. The like is to be understood of the second and fourth Examples.

In *Example* 3. I begin with $\frac{2}{8}$, as $\frac{1}{4}$ of a *Penny*, which gives 1696 $\frac{3}{4}$ *Pence*, the Price of the Quantity, at $\frac{2}{8}$ of a *Penny per Pound*, $\frac{1}{2}$ of which is the Price at $\frac{1}{8}$, these added together gives 2545 *Pence*, the Price of 6787 *Pounds*, at $\frac{3}{8}$ of a *Penny per Pound*, reduced into *Pounds* gives 10 *l.* 12 *s.* 1 *d.* The like is to be understood of the 5th, 6th, and 7th Examples.

2756 Grains at 1 Penny *per* Grain.

d.		2756	
1	$\frac{1}{12}$	*Sh.* 22|9	8
		£. 11 9	8

3521 Gr. at 1 *d.* $\frac{1}{2}$ *per* Grain.

d.		3521	
1$\frac{1}{2}$	$\frac{1}{8}$	*Sh.* 44|0	1$\frac{1}{2}$
		£. 22 0	1$\frac{1}{2}$

5672 Pennywt. at 2 *d. per* Pennywt.

d.		5672	
2	$\frac{1}{6}$	*Sh.* 94|5	4
		£. 47 5	4

3726 Pennywt. at 3 *d. per* Pennywt.

d.		3726	
3	$\frac{1}{4}$	*Sh.* 93|1	6
		£. 46 11	6

3794 Ounces, at 4 *d. per* Ounce.

d.			
		3794	
4	$\frac{1}{3}$	*Sh.* 126|4	8
		£. 63 4	8

5648 Ounces, at 6 *d. per* Ounce.

d.			
		5648	
6	$\frac{1}{2}$	*Sh.* 282|4	
		£. 141	4

In the *first* of the preceeding *Examples*, becauſe 1 *Penny* is the $\frac{1}{12}$ of a *Shilling*, I divide the Quantity by 12, the Quotient is 229 *Shillings* and 8 *Pence*; which reduced into *Pounds*, gives 11 *l.* 9 *s.* 8 *d.* for the Price of 2756 *Grains*, at 1 *Penny per Grain*, as in the *Example*.

The like is to be underſtood of all the reſt of the *Examples*.

Note, In the following *Examples* I take firſt the greateſt even Part, and then part of that Part, *&c.* and add all together; the Sum total is the *Amount* of the *Quantity* at the given *Price*.

4254 *Ounces*, at 5 *d. per Ounce*.

d.			
		4254	
4	$\frac{1}{3}$	*Sh.* 1418	
1	$\frac{1}{4}$	354	6
		Sh. 177|2	6
		£. 88 12	6

3729 *Ounces* at 7 *d. per Ounce*.

d.			
		3729	
6	$\frac{1}{2}$	*Sh.* 1864	6
1	$\frac{1}{6}$	310	9
		Sh. 217|5	3
		£. 108 15	3

9271 *Pounds* at 8 *d. per Pound*.

d.			
		9271	
6	$\frac{1}{2}$	*Sh.* 4635	6
2	$\frac{1}{3}$	1545	2
		Sh. 618|0	8
		£. 309 0	8

6728 *Pounds* at 9 *d. per Pound*.

d.			
		6728	
6	$\frac{1}{2}$	*Sh.* 3364	
3	$\frac{1}{2}$	1682	
		Sh. 504|6	
		£. 252	6

4268 *Pounds* at 10 *d.* $\frac{1}{8}$ *per Pound.*

d.				
			4268	
		Sh.	2134	
6	$\frac{1}{2}$		1067	
3	$\frac{1}{2}$		355	8
1	$\frac{1}{3}$		44	$5\frac{1}{2}$
$\frac{1}{8}$	$\frac{1}{8}$	*Sh.*	360|1	$1\frac{1}{2}$
		£.	180 1	$1\frac{1}{2}$

3926 *Pounds* at 11 *d.* $\frac{5}{8}$ *per Pound.*

d.				
			3926	
		Sh.	1963	
6	$\frac{1}{2}$		981	6
3	$\frac{1}{2}$		654	4
2	$\frac{1}{3}$		163	7
$\frac{4}{8}$	$\frac{1}{4}$		40	$10\frac{3}{4}$
$\frac{1}{8}$	$\frac{1}{4}$	*Sh.*	380|3	$3\frac{3}{4}$
		£.	190 3	$3\frac{3}{4}$

$4926\frac{1}{4}$ *Ells* at 5 *d.*$\frac{1}{4}$ *per Ell.*

d.				
			4926	
4	$\frac{1}{3}$	*Sh.*	1642	
1	$\frac{1}{4}$		410	6
$\frac{1}{4}$	$\frac{1}{4}$		102	$7\frac{1}{2}$
$E\frac{1}{4}$	$\frac{1}{4}$			$1\frac{1}{4}$
		Sh.	215|5	$2\frac{3}{4}$
		£.	107 15	$2\frac{3}{4}$

$5128\frac{1}{2}$ *Ells* at 7 *d.*$\frac{1}{2}$ *per Ell.*

d.				
			5128	
6	$\frac{1}{2}$	*Sh.*	2564	
1	$\frac{1}{6}$		427	4
$\frac{1}{2}$	$\frac{1}{2}$		213	8
$\frac{1}{2}E$	$\frac{1}{2}$			$3\frac{3}{4}$
		Sh.	320|5	$3\frac{3}{4}$
		£.	160 5	$3\frac{3}{4}$

$5719\frac{3}{4}$ *Stone,* at 9 *d.*$\frac{3}{4}$ *per Stone.*

d.				
			5719	
6	$\frac{1}{2}$	*Sh.*	2859	6
3	$\frac{1}{3}$		1429	9
$\frac{1}{2}$	$\frac{1}{6}$		238	$3\frac{1}{2}$
$\frac{1}{4}$	$\frac{1}{2}$		119	$1\frac{3}{4}$
$\frac{1}{2}S.$	$\frac{1}{2}$			$4\frac{3}{4}$
$\frac{1}{4}$	$\frac{1}{2}$			$2\frac{1}{4}$
		Sh.	464|7	$3\frac{1}{4}$
		£.	232 7	$3\frac{1}{4}$

$6251\frac{3}{4}$ *Stone,* at 11 *d.*$\frac{3}{4}$ *per Stone.*

d.				
			6251	
6	$\frac{1}{2}$	*Sh.*	3125	6
3	$\frac{1}{2}$		1562	9
2	$\frac{1}{3}$		1041	10
$\frac{1}{2}$	$\frac{1}{4}$		260	$5\frac{1}{2}$
$\frac{1}{4}$	$\frac{1}{2}$		130	$2\frac{3}{4}$
$\frac{1}{2}S.$	$\frac{1}{2}$			$5\frac{3}{4}$
$\frac{1}{4}$	$\frac{1}{2}$			$2\frac{1}{4}$
		Sh.	612|1	$5\frac{3}{4}$
		£.	306 1	$5\frac{3}{4}$

In the Examples following, the Price being at *even Parts* of a *Pound*, I divide the *Quantity* by that Part; it anſwers the *Queſtion*, and needs no further Explication.

2837 Dozen at 1 *s.* 8 *d. per Dozen.*

		2837
s.d.		
1 8	$\frac{1}{12}$	£. 236 8 4

4279 Dozen at 2 *s. per Dozen.*

		4279
S.		
2	$\frac{1}{10}$	£. 427 18

259 *Score,* at 2 *s.* 6 *d. per Score.*

		259
s.d.		
26	$\frac{1}{8}$	£. 32 7 6

658 *Score,* at 3 *s.* 4 *d. per Score.*

		658
s.d.		
34	$\frac{1}{6}$	£. 109 13 4

432 *Yards* $\frac{1}{4}$ at 4 *s. per Yard.*

		432
S.		
4	$\frac{1}{5}$	£. 86 8
$\frac{1}{4}$ *Y.*	$\frac{1}{4}$	1
		£. 86 9

573$\frac{1}{2}$ *Yards* at 5 *s. per Yard.*

		573
S.		
5	$\frac{1}{4}$	£. 143 5
$\frac{1}{2}$ *Y.*	$\frac{1}{2}$	2 6
		£. 143 7 6

doz. lb.
657 11 at 6 *s.* 8 *d. per Dozen.*

		657
s.d.		
68	$\frac{1}{3}$	£. 219
6 *lb*	$\frac{1}{2}$	3 4
3	$\frac{1}{2}$	1 8
2	$\frac{1}{3}$	1 1$\frac{1}{4}$
		£. 219 6 1$\frac{1}{4}$

doz. lb.
783 10 at 10 *s. per Dozen.*

		783
s.		
10	$\frac{1}{2}$	£. 391 10
6 *lb*	$\frac{1}{2}$	5
3	$\frac{1}{2}$	2 6
1	$\frac{1}{3}$	10
		£. 391 18 4

Note, In the following *Examples* I take first the *greatest* even Part, and then part of that Part, &c. and add the *Quotients* into one Sum.

579 *Yards* at 6 *s.* per *Yard.*

S.		
		579
5	$\frac{1}{4}$	£. 144 15
1	$\frac{1}{5}$	28 19
		£. 173 14

654 *Yards* at 12 *s.* per *Yard.*

S.		
		654
10	$\frac{1}{2}$	£. 327
2	$\frac{1}{5}$	65 8
		£. 392 8

375 *Ells* at 14 *s.* per *Ell.*

S.		
		375
10	$\frac{1}{2}$	£. 187 10
2	$\frac{1}{5}$	37 10
2	D.	37 10
		£. 262 10

728 *Ells* at 18 *s.* per *Ell.*

S.		
		728
10	$\frac{1}{2}$	£. 364
5	$\frac{1}{2}$	182
2	$\frac{1}{5}$	72 16
1	$\frac{1}{2}$	36 8
		£. 655 4

438 *Months* at 7 *s.* per *Month.*

S.		
		438
5	$\frac{1}{4}$	£. 109 10
1	$\frac{1}{5}$	21 18
1	D.	21 18
		£. 153 6

675 *Months* at 11 *s.* per *Month.*

S.		
		675
10	$\frac{1}{2}$	£. 337 10
1	$\frac{1}{10}$	33 15
		£. 371 5

		695 Weeks at 17 *s. per Week.*	
		695	
S.		£. 347	10
10	$\frac{1}{2}$	173	15
5	$\frac{1}{2}$	69	10
2	$\frac{1}{5}$		
		£. 590	15

		848 Weeks at 19 *s. per Week.*	
		848	
S.		£. 424	
10	$\frac{1}{2}$	212	
5	$\frac{1}{2}$	84	16
2	$\frac{1}{5}$	84	16
2	*D.*	805	12

If the *Quantity* be multiplied with half the Number of *Shillings*, the *Units* in the Product *doubled* for *Shillings*, the Residue will be *Pounds*; and shew the *Amount* of the *Quantity* at the Price of that Number of *Shillings* you took the *Half* of, and hereby you may somewhat contract the preceeding *Operations*. I shall therefore repeat the same Examples.

S.	*M*	*579 Yards* at 6 *s. per Yard.*	
6	3	579	
		£. 173	14

S.	*M*	*654 Yards* at 12 *s. per Yard.*	
12	6	654	
		£. 392	8

In *Example* 1. I multiply the *Quantity* by 3, the Product is 1737. I *double* the *Units* 7 for *Shillings*, which gives 14 *Shillings*, and so have 173 *l.* 14 *s.* for the Price of 579 *Yards*, at 6 *Shillings per Yard.* The like is to be understood in all the rest of the *Examples* insuing.

S.	*M*	*375 Ells* at 14 *s. per Ell.*	
		375	
14	7	£. 262	10

S.	*M*	*728 Ells* at 18 *s. per Ell.*	
		728	
18	9	£. 655	4

438

438 *Months* at 7 *s.* *per Month.*

S.	M			
			438	
6	3	£.	131	8
1	1/6		21	18
		£.	153	6

675 *Months* at 11 *s.* *per Month.*

S.	M			
			675	
10	5	£.	337	10
1	1/10		33	15
		£.	371	5

695 *Weeks* at 17 *s.* *per Week.*

S.	M				
			695		
14	7	£.	486	10	
2	1/7		69	10	
1	1/2		34	15	0¼
		£.	590	15	0¼

848 *Weeks* at 19 *s.* *per Week.*

S.	M			
			848	
16	8	£.	678	8
2	1/8		84	16
1	1/2		42	8
		£.	805	12

In theſe two *Examples* preceeding, I begin with 14 *l.* and 16 *s.* becauſe, ſhould I begin with 16 and 18, the odd *Shilling* would require 16 and 18 for *Diviſors*, to find the Value of the *Quantity*, at 1 *s.* *per Week*: Which is not convenient.

⊕ s. d.
56½ at 4 9 *per* ⊕

S.	M				
			56		
4	2	£.	11	4	
6*d*	1/8		1	8	
3	1/2			14	
½ ⊕	1/2			2	4½
		£.	13	8	4½

⊕ s. d.
75¼ at 6 9 *per* ⊕

S.	M				
			75		
6	3	£.	22	10	
9*d*	1/8		2	16	3
⅛ ⊕	1/4			1	8¼
		£.	25	7	11¼

57

Y. qu. na. s. d.
57 3 3 at 14 7¼ *per Yard.*

S.	M	57		
12	6	£. 34	4	
2	1/6	5	14	
6*d*	1/4	1	8	6
1	1/6		4	9
1/4	1/4		1	2¼
2*q*	1/2		7	3½
1	1/2		3	7¾
2*q*.	1/2		1	9¾
1	1/2			10¾
		£. 52	6	1

Y. qu. na. s. d.
84 2 1 at 16 11½ *per Yard.*

S.	M	84		
14	7	£. 58	16	
2	1/7	8	8	
6*d*	1/4	2	2	
3	1/2	1	1	
2	1/3		14	
1/2	1/4		3	6
2*q*.	1/2		8	5¼
1	1/8		1	0½
		£. 71	14	0¼

C *qu.* ℔
65 3 27 at 13*s.* 6 *d.*¾ *per* C

S.	M	65		
12	6	39	0	
1	1/12	3	5	
6*d*	1/2	1	12	6
3/4	1/8		4	0¾
2*q*.	1/2		6	9¼
1	1/2		3	4½
16*l*	1/7		1	11¼
8	1/2			11½
2	1/4			2¾
1	1/2			1¼
		£. 44	14	11¼

C *qu.* ℔
72 1 19 at 19*s.* 9 *d.*¾ *per* C

S.	M	72		
16	8	£. 57	12	
2	1/8	7	4	
1	1/2	3	12	
6*d*	1/2	1	16	
3	1/2		18	
3/4	1/4		4	6
1*q*.	1/4		4	11¼
16*l*	1/7		2	9¾
2	1/8			4
1	1/2			2
		£. 71	14	9

If the *Question* be upon *Pounds, &c.* multiply the *Quantity* by the *Pounds*; and for your *Shillings* and *Pence* (if any) Work by the preceeding Rules, as Conveniency may arise.

Tun.

hhd.		
1	$\frac{1}{4}$	
9 g.	$\frac{1}{7}$	
1	$\frac{1}{7}$	
1	D.	
2 q.	$\frac{1}{2}$	
1 pi.	$\frac{1}{4}$	

Tun hhd. ga. qu. pi.
796 1 11 2 1
at 7 *l.* per Tun.

796		
7		
£. 5572		
........1	15	
....	5	
....		$6\frac{1}{2}$
....		$6\frac{1}{2}$
....		$3\frac{1}{4}$
....		$\frac{1}{4}$
£. 5574	1	5

S.	m.
16	8
2 hh	$\frac{1}{2}$
21 g	$\frac{1}{6}$
21	D.
3	$\frac{1}{7}$
3	D.
2 q.	$\frac{1}{8}$
1	$\frac{1}{2}$
1 pi.	$\frac{1}{2}$

Tun hhd ga. qu. pi.
528 2 48 3 1
at 9 *l.* 16 *s.* per Tun.

528		
9		
£. 4752		
... 422	8	
..... 4	18	
.....	16	4
.....	16	4
......	2	4
......	2	4
....		$4\frac{1}{2}$
....		$2\frac{1}{4}$
....		1
£. 5181	3	$11\frac{3}{4}$

S.	M
14	7
2	$\frac{1}{7}$
1	$\frac{1}{2}$
6 d.	$\frac{1}{2}$
2	$\frac{1}{3}$
2 q.	$\frac{1}{2}$
1	$\frac{1}{2}$
14 lb	$\frac{1}{2}$
7	$\frac{1}{2}$

C. qu. lb
375 3 21 at
2 *l.* 17 *s.* 8 *d.* per C.

375		
2		
£. 750		
... 262	10	
.... 37	10	
.... 18	15	
..... 9	7	6
..... 3	2	6
...... 1	8	10
....	14	5
....	7	$2\frac{1}{2}$
....	3	$7\frac{1}{4}$
£. 1083	19	$8\frac{1}{4}$

S.	M
10	5
1	$\frac{1}{10}$
6 d.	$\frac{1}{2}$
1 q.	$\frac{1}{4}$
14 lb	$\frac{1}{2}$

C. qu. lb
227 1 14 at
3 *l.* 11 *s.* 6 *d.* per C.

227		
3		
£. 681		
.... 113	10	
.... 11	7	
..... 5	13	6
....	17	$10\frac{1}{2}$
....	8	$11\frac{1}{4}$
£. 812	17	$3\frac{3}{4}$

		lb. 572	*oz.* 11	*dwt.* 5 *gr.* 7 at
		£. 7	18	9 *per lb.*
		572		
		7		
Sb.	*M.*	£. 4004		
16	8	. . 457	12	
2	$\frac{1}{8}$	. . . 57	4	
6 *d.*	$\frac{1}{4}$	. . . 14	6	
3	$\frac{1}{2}$	 7	3	
6 *oz.*	$\frac{1}{2}$	 3	19	$4\frac{1}{2}$
3	$\frac{1}{2}$	 1	19	$8\frac{1}{4}$
2	$\frac{2}{3}$	 1	6	$5\frac{1}{2}$
4 *dwt.*	$\frac{1}{10}$	. . . . . .	2	$7\frac{3}{4}$
1	$\frac{1}{4}$	. . . . . .	. . . .	$7\frac{3}{4}$
6 *gr.*	$\frac{1}{4}$	. . . . . .	. . . .	$1\frac{3}{4}$
1	$\frac{1}{6}$	. . . . . .	. . . .	$\frac{1}{4}$
		£. 4547	13	$11\frac{3}{4}$

		lb. 653	*oz.* 9	*dwt.* 3 *gr.* 5 at
		£. 15	16	$8\frac{1}{4}$ *per lb.*
		653		
		15		
		3265		
		653		
Sb.	*M.*	£. 9795		
14	7	. . . 457	2	
2	$\frac{1}{7}$	. . . 65	6	
6 *d.*	$\frac{1}{4}$	. . . 16	6	6
2	$\frac{1}{3}$	 5	8	10
$\frac{1}{2}$	$\frac{1}{4}$	 1	7	$2\frac{1}{2}$
$\frac{1}{4}$	$\frac{1}{2}$	. . . . . .	13	$7\frac{1}{4}$
6 *oz.*	$\frac{1}{2}$	 7	18	$4\frac{1}{4}$
2	$\frac{1}{3}$	 2	12	$9\frac{1}{4}$
1	$\frac{1}{2}$	 1	6	$4\frac{1}{2}$
2 *dwt.*	$\frac{1}{10}$	. . . . . .	2	$7\frac{1}{2}$
1	$\frac{1}{2}$	. . . . . .	1	$3\frac{3}{4}$
4 *gr.*	$\frac{1}{6}$	. . . . . .	. . . .	$2\frac{1}{2}$
1	$\frac{1}{4}$	. . . . . .	. . . .	$\frac{1}{2}$
		£. 10353	5	10

Thus having finiſhed what I intended upon the five General Parts of *Arithmetic*; I ſhall now proceed to ſhew the Uſe of *Fractions*, both *Vulgar* and *Decimal*; and becauſe the Work of *Decimals* differs not from whole Numbers, but in ſeparating the *Decimals* from the *Integers* (after I have given you the Definition of a *Fraction*) ſhall begin with Decimal Arithmetic.

FRACTIONS are of two Kinds, *viz. Vulgar* and *Decimal*.

A Vulgar Fraction is that which represents a Part or Parts of any thing proposed; and is expressed by two Numbers placed one above the other, with a Line drawn betwixt them; the upper Number being called the *Numerator*, and the under the *Denominator*.

Numerator $\frac{3}{4}$ thus expressed $\frac{\text{Three}}{\text{Fourths}}$ of an Unit.
Denominator

The *Denominator* denotes the Number of equal Parts that the Thing is divided into, and the *Numerator* denotes the Number of Parts that are contained in the Fraction.

A *Decimal Fraction* is such a one whose *Denominator* is an *Unit*, with as many Cyphers annexed, as there be Figures in the Numerator.

as $\frac{5}{10}$ thus expressed $\frac{\text{Five}}{\text{Tenths}}$ Parts of an Unit.

$\frac{75}{100}$ . . . . $\frac{\text{Seventy-five}}{\text{Hundreds}}$

$\frac{125}{1000}$ . . . . $\frac{\text{One hundred twenty-five}}{\text{Thousands}}$

DECIMAL ARITHMETIC,

Is an artificial Invention of managing *Fractions*, or broken Numbers, by a much more commodious and easy Way than that of *Vulgar Fractions*; and supposeth every whole *Unit* to be divided into *Ten* Parts, and therefore they are called *Decimal* Fractions, the Number 10 being always the least *Denominator*; but because this small Number is not sufficient so plainly and fully to distinguish the Value of all *Fractions*, it is still increased by 10, *viz.* to 100, 1000, 10000, 100000, or into as many *Tenths* as you please; but still the *Numerator* and *Denominator* bear the same Value and Proportion

portion to each other, as if they were in lesser Numbers.

The *Denominators* of *Decimal* Fractions are never set down, but only the *Numerators*, which are distinguished from the *Integers*, or Whole Numbers, by a *Period*, or some other Note of Distinction, as in the following Examples.

Thus, 5.7 expressed thus, $5\frac{7}{10}$

25.78 . . . . $25\frac{78}{100}$

36.069 . . . . $36\frac{69}{1000}$

347.7298 . . . . . $347\frac{7298}{10000}$

322.007298 . . . . $322\frac{7298}{1000000}$

Note: Cyphers annexed to a *Decimal*, alters not its Value.

For .5 and .50 or .500 are equal one to another.

But *Cyphers* prefixed, decreases their Value.

As .5 is five Parts of 10
.05 is five Parts of 100
.005 is five Parts of 1000, *&c.*

Vulgar Fractions are reduced into *Decimal* ones by this General Rule.

RULE.

Annex *Cyphers* to the *Numerator*, and then divide by the *Denominator*; the *Quotient* gives the *Decimal* Parts equal to the given Fraction, or at least so near it as may be thought necessary to approach.

Note: the *Quotient* must contain as many *Decimal* Places, as there are *Cyphers* annexed, and when wanting, must be supply'd by prefixing *Cyphers*.

Let $\frac{1}{4}$ $\frac{1}{2}$ $\frac{3}{4}$ $\frac{2}{3}$ $\frac{7}{8}$ $\frac{11}{12}$ $\frac{23}{56}$ $\frac{398}{3990}$ and $\frac{21}{2792}$ be reduced into Decimals.

$\frac{1}{4}$) 1.00 (.25 Rem. 0	$\frac{1}{2}$) 1.0 (.5 Rem. 0	$\frac{3}{4}$) 3.00 (.75 Rem. 0	$\frac{2}{3}$) 2.0000 (.6666 Rem. 2
$\frac{7}{8}$ 7.000 (.875 Rem. 0	$\frac{11}{12}$) 11.0000 (.9166 Rem. 8	$\frac{23}{56}$) 23.000000 (.410714 Rem. 16	
$\frac{398}{3990}$) 398.000000 (.099749 Rem. 1490	$\frac{21}{2792}$) 21.000000 (.007521 Rem. 1368		

Note: In reducing *Vulgar* Fractions to *Decimals*, if nothing remain, the *Decimal* Fraction is exactly equal to the *Vulgar*: But if there be any Remainder, it is not so; yet by annexing more *Cyphers*, and continuing the Division, you may bring them very near the Truth; but 6 or 7 Places will be near enough for most Operations

From hence it will not be difficult to find the *Decimal* Parts of *Money*, *Weight*, or *Measure*, if you first reduce the given Parts of *Money*, *Weight*, or *Measure* into a *Vulgar* Fraction, whose *Denominator* is the Number of those known Parts contained in the *Integer*, and the given Parts its *Numerator*; as will plainly appear in the following Examples:

Let the following Sums of Money be reduced into *Decimals*, a *Pound* being *Integer*, *viz.* 18 *s.* and 3 *s.* 6 *d.* and 2 *s.* 5 ½ *d.* and 11 *d.* and 4 ¼ *d.* and ¾ *d.* ½ *d.* and ¼ *d.*

First,

First, 18 *Shillings* is $\frac{18}{20}$ of a *Pound*.

Again, 3*s.* 6*d.* is 42 *Pence*, that is $\frac{42}{240}$ of a *Pound*; and 2*s.* 5 $\frac{1}{2}$*d.* is 118 *Farthings*, that is, $\frac{118}{960}$ of a *Pound*; and 11 *Pence* is $\frac{11}{240}$ of a *Pound*; and 4 $\frac{1}{4}$ *d.* is 17 *Farthings*, that is $\frac{17}{960}$ of a *Pound*; and $\frac{3}{4}$*d.* is $\frac{3}{960}$ of a *Pound*; and $\frac{1}{2}$*d.* is $\frac{2}{960}$ of a *Pound*; and $\frac{1}{4}$ *d.* is $\frac{1}{960}$ of a *Pound*.

Therefore these *Fractions*,

$$\frac{18}{20}\quad\frac{42}{240}\quad\frac{118}{960}\quad\frac{11}{240}\quad\frac{17}{960}\quad\frac{3}{960}\quad\frac{2}{960}\quad\frac{1}{960}$$

must be reduced into *Decimals* as followeth:

$\frac{18}{20}$) 18.0 (.9 Rem. 0 $\frac{42}{240}$) 42.000 (.175 Rem. 0 $\frac{118}{960}$) 118.000000 (.122916 Rem. 640

$\frac{11}{240}$) 11.000000 (.045833 Rem. 80 $\frac{17}{960}$) 17.000000 (.017708 Rem. 320 $\frac{3}{960}$) 3.000000 (.003125 Rem. 0

$\frac{2}{960}$) 2,000000 (.002083 Rem. 320 $\frac{1}{960}$) 1.000000 (.001041 Rem. 640

Again, Let the following Sums of Money be reduced into *Decimals*, a *Shilling* being *Integer*, *viz.* 11*d.* and 8 $\frac{1}{2}$ *d.* and $\frac{3}{4}$ *d.* $\frac{1}{2}$ *d.* and $\frac{1}{4}$ *d.*

First, 11 *Pence* is $\frac{11}{12}$ of a *Shilling*, and 8 $\frac{1}{2}$ *d.* is 34 *Farthings*, that is $\frac{34}{48}$ of a *Shilling*, and $\frac{3}{4}$ *d.* is $\frac{3}{48}$, and $\frac{1}{2}$ *d.* is $\frac{2}{48}$, and $\frac{1}{4}$ *d.* is $\frac{1}{48}$ of a *Shilling*. Therefore these *Fractions* $\frac{11}{12}$ $\frac{34}{48}$ $\frac{3}{48}$ $\frac{2}{48}$ and $\frac{1}{48}$ must be reduced into *Decimals*, as afore.

$\frac{11}{12}$ .916666
12)11.000000
Rem. 8

$\frac{34}{48}$ .708333
48)34.000000
Rem. 16

$\frac{3}{48}$ .0625
48)3.0000
Rem. 0

$\frac{2}{48}$ .041666
48)2.000000
Rem. 32

$\frac{1}{48}$ .020833
48)1.000000
Rem. 16

In like Manner may *Weight*, and *Measure* be reduced into *Decimals*.

Let 3 *qu.* 27 *lb.* 1 *qu.* 19 *lb.* and 17 *lb.* be reduced into *Decimals*, an *Hundred Weight* being *Integer*.

3 *qu.* 27 *lb.* is 111 *lb.* that is, $\frac{111}{112}$ of an ⊕. and 1 *qu.* 19 *lb.* is 47 *lb.* that is, $\frac{47}{112}$ of an ⊕. and 17 *lb.* is $\frac{17}{112}$ of an ⊕. Therefore $\frac{111}{112}$ and $\frac{47}{112}$ and $\frac{17}{112}$ must be reduced into *Decimals*, and they will produce as followeth.

$\frac{111}{112}$ .991071
112)111.000000
Rem. 48

$\frac{47}{112}$ .419642
112)47.000000
Rem. 96

$\frac{17}{112}$ .151785
112)17.000000
Rem. 80

So likewise, if the *Decimal* of 2 *qu.* 3 *na.* be required, because 2 *qu.* 3 *na.* is 11 *Nails*, that is, $\frac{11}{16}$ of a *Yard*; therefore $\frac{11}{16}$ reduced into a *Decimal* is .6875.

Also, if the *Decimal* of 75 *Days* be required, then $\frac{75}{365}$ reduced into a *Decimal*, will produce it.

Having thus shewn from whence *Decimal Fractions* arise; I shall now proceed to the Management of

of them in the Rules of *Addition*, *Subtraction*, *Multiplication*, and *Division*.

ADDITION of DECIMALS.

THE *Periods* or *Decimal* Points must stand in a direct Line one under another, and the Number of *Decimal* Parts in the *Total*, must be as many as are the most in the given Numbers.

£.	℔ *Troy*	*Yards*
387.29467	5719.2843	67142.9718
267.1973	317.269	3719.7142
492.6835	412.371	462.916
271.9469	57.29	71.937
382.719	54.72	1.84
467.284	6.9	9.7
£. 2269.12537	℔ 6567.8343	*ya.* 71409.0790
20	12	4
Sh. 2.50740	*oz.* 10.0116	*qu.* .3160
12	20	4
d. 6.08880	*dwt.* 0.2320	*na.* 1.2640
	24	
	9280	
	4640	
	gr. 5.5680	

In these *Examples* the *Total* is obtained by adding them together, as in *Addition* of *Integers*; and for the Value of the *Decimal Fraction*, I multiply it with the Number of *Units* that are contained in the next lower *Denomination*, retaining so many *Decimal* Places in the *Product* as were in the *Total*; and the rest are *Integers* of that *Denomination*, and so proceed to the lowest *Denomination*, as is plain from

from the preceeding *Examples*, and will further appear as we go on.

SUBTRACTION of DECIMALS.

AS in *Addition*, so in *Subtraction*, the *Period* or *Decimal* Points must stand in a direct Line one under another, and the Number of *Decimals* in the *Remainder*, must be as many are the most in the given Numbers.

	£.		⊕
From	719467.287939		7524.91673
Take	29763.94671		1978.931792
Rem.	£. 689703.341229	⊕	5545.984938
	20		4
Sh.	6.824580	*qu.*	3.939752
	12		28
d.	9.894960		7518016
	4		1879504
f.	3.579840	℔	26.313056

Multiplication of Decimals.

THE Number of *Decimal* Parts in the *Multiplicand* and *Multiplier* counted together, must be cut off in the *Product*:

But if it should so happen that the Number of *Figures* in the *Product* be less than the Number of *Decimal* Parts in the *Multiplicand* and *Multiplier* counted together, then so many *Cyphers* must be pre-fixed

fixed as will make up the Number of *Decimal* Parts there equal to the Number of *Decimal* Parts in the *Multiplicand* and *Multiplier* counted together.

	£.
mult.	7184627.9148
	by .7
£.	5029239.54036
	20
Sh. - -	10.80726
	12
d. - - -	9.68712
	4
f. - - - -	2.74848

	lb *Averdupoize*
mult.	.124765348
	by .5
lb	.0623826740
	16
	3742960440
	623826740
oz.	9981227840
	16
	59887367040
	9981227840
dr.	15.9699645440

	Feet
mult.	71946729.3
	by .39
	6475205637
	2158401879
Feet	28059224.427
	12
Inches	5.124

mult.	.1271937146
	by .0124
	.00157720206104

	Weeks
mult.	3152.796
	by 48
	25222368
	12611184
Weeks	151334.208
	7
Days	1.456
	24
	1824
	912
Hours	10.944
	60
Min.	56.640

In

In the *Example* of *Pounds* there are *four Decimals* in the *Multiplicand*, and *one* in the *Multiplier*, therefore I cut off *five* in the *Product*.

In the *Example* of *Pounds Averdupoize* there is *nine Decimals* in the *Multiplicand*, and *one* in the *Multiplier*, which is *ten*, to be cut off in the *Product*; but there are but *nine Figures* in the *Product*; therefore *one Cypher* is prefixed to make *ten*.

Understand the like in the rest of the *Examples*.

Division of Decimals.

FROM the Number of *Decimal* Parts in the *Dividend*, take the Number of *Decimal* Parts in the *Divisor*, the *Remainder* is the Number of *Decimal* Parts that must be cut off in the *Quotient*.

If the *Dividend* have no *Decimal* Parts, or a less Number of *Decimal* Parts than are in the *Divisor*, then so many *Cyphers* at least, must be annexed to the *Dividend*, as will make the Number of *Decimals* there equal to the Number of *Decimal* Parts in the *Divisor*.

And if it should so happen, that the Number of *Figures* in the *Quotient*, be less than the *Difference* between the *Dividend* and *Divisor*, then so many *Cyphers* must be prefixed as will make the Number of *Decimal* Parts there, equal to the *Difference* between the *Dividend* and *Divisor*.

742934	5313.5245
.5)371467.2	.7)3719.46719
Rem. 2	*Rem.* 4

3021630	5196612
.9)2719467.0	.08)415729.00
Rem. 0	Rem. 4
1928	.00725
37.2946)71927.2100	374.6)2.719462
Rem. 232212	Rem. 3612

In the first *Example*, there being *one Decimal* in the *Dividend*, and *one* in the *Divisor*, there remains none to be cut off in the *Quotient*, so that the *Quotient* is all *Integers*.

Example 2. There are *five Decimals* in the *Dividend*, and *one* in the *Divisor*, therefore *one* from *five* remains *four Decimals*, to be cut off in the *Quotient*.

Example 3. There being no *Decimals* in the *Dividend*, and *one* in the *Divisor*, *one Cypher* is annexed to the *Dividend*, and the *Quotient* is all *Integers*.

Example 4. There being no *Decimals* in the *Dividend*, and *two* in the *Divisor*, *two Cyphers* are annexed to the *Dividend*, and the *Quotient* is all *Integers*.

Example 5. There being *two Decimals* in the *Dividend*, and *four* in the *Divisor*, *two Cyphers* are annexed to the *Dividend*, and the *Quotient* is all *Integers*.

Example 6. There being *six Decimals* in the *Dividend*, and *one* in the *Divisor*, *one* from *six* remains *five*, to be cut off in the *Quotient*; but the *Quotient* having but *three Figures*, *two Cyphers* are prefixed.

Note, In those *Examples* where *Cyphers* are annexed, but so many are annexed, as makes the *Decimal* Parts equal to the Number of *Decimal* Parts in the *Divisor*, you may annex as many more as you please, and then the *Quotient* will consist of some *Decimal* Parts besides the *Integers*.

The Computation of the Duties payable in the *Custom-house* upon Goods imported or exported, requiring some Skill in *Decimals*; I shall here add some Examples thereupon.

1. What is the *Duty* of 96 *Dozen*, at *Sh.* 1 : 8.52 *per Dozen*.

```
          6 10
    ------------
  Sh. 17 : 1.20
             9
    ------------
£. 7:13:10.80
      10 : 3.12
    ------------
£. 8 : 4 : 1.92 Duty.
```

Note, the *Penny* is divided into 100 Parts.

2. What is the *Duty* of 108 *Gross*, at *Sh.* 2 : 6.49½ *per Gross*.

```
             8 10
      -------------
  £. 1 : 5 : 4.95
               10
      -------------
 £. 12:14 : 1.50
      1 : 0 : 3.96
      -------------
 £. 13:14 : 5.46 Duty.
```

3. What

3. What is the *Duty* of 496 *Pounds*, at *d.* $1.03\frac{1}{8}$ *per Pound.*

6 10

d. $10.31\frac{2}{8}$

9 10

Sh. 8 : $7.12\frac{4}{8}$

4

£. 1 : 14 : 4.50

7 : $8.81\frac{2}{8}$

$6.18\frac{6}{8}$

£. 2 : 2 : 7.50 *Duty.*

4. What is the *Duty* of 296 *Pieces*, at *Sh.* 1 : $10.72\frac{1}{4}$ *per Piece.*

6 10

Sh. 18 : $11.22\frac{1}{2}$

9 10

£. 9 : 9 : 6.25

2

£. 18 : 19 : 0.50

8 : 10 : 5 $.2\frac{1}{2}$

11 : $4.33\frac{1}{2}$

£. 28 : 0 : 9.86 *Duty.*

5. What is the *Duty* of 729 Skins, at *d.* $1.89\frac{3}{8}$ *per Skin.*

9 10

Sh. 1 : $6.93\frac{6}{8}$

2 10

Sh. 15 : $9.37\frac{4}{8}$

7

£. 5 : 10 : $5.62\frac{4}{8}$

3 : $1.87\frac{4}{8}$

1 : 5 $.4\frac{3}{8}$

£. 5 : 15 : $0.54\frac{3}{8}$ *Duty.*

6. What

6. What is the *Duty* of 649 *Skins*, at
d. 0.65$\frac{5}{8}$ *per Skin.*

9 10

d. 6.56$\frac{2}{8}$

4 10

Sh. 5 : 5.62$\frac{4}{8}$

6

£. 1 : 12 : 9.75

2 : 2.25

5.90$\frac{5}{8}$

£. 1 : 15 : 5.90$\frac{5}{8}$ *Duty.*

7. What is the *Duty* of 127$\frac{3}{4}$ *Dozens*, at
Sh. 1 : 3.28 $\frac{7}{8}$ *per Dozen.*

7 10

Sh. 12 : 8.88 $\frac{6}{8}$

2 10

£. 6 : 7 : 4.87 $\frac{4}{8}$

1 : 5 : 5.77 $\frac{4}{8}$

8 : 11 .2 $\frac{1}{8}$

$\frac{1}{2}$ *doz.* - - - - - - 7.64 $\frac{3}{8}$ $\frac{1}{2}$

$\frac{1}{4}$ *doz.* - - - - - - 3.82 $\frac{1}{8}$ $\frac{1}{2}$ $\frac{1}{4}$

£. 8 : 2 : 9.13 $\frac{6}{8}$ $\frac{1}{4}$ *Duty.*

8. What

8. What is the *Duty* of 479 : 3 : 26 at *Sb*. 3 : 3.63 ¼ per ⊕ (qu. lb)

		9 10	
	£. 1 : 13 : 0.37 ½		
		7 10	
	£. 16 : 10 : 3.75		
		4	
	£. 66 : 01 : 3.00		
	11 : 11 : 2.62 ½		
qu.	1 : 09 : 8.73 ¾		
2 ½	- - - 1 : 7.81 ¾	¼	
1 ½	- - - - - 9.90	½	¼
lb. 16 1/7	- - - - - 5.56 ¼		
8 ½	- - - - - 2.83	½	
2 ¼	- - - - - .70 ¾	½	
£. 79 : 5 : 5.29		¼ ½	

9. What

9. What is the *Duty* of 22 : 1 : 15 (℔ *qu. lb.*) at 6 : 8 (*s. d.*) *per Pound*, paying 5 *per Cent*. and 5 *per Cent*. off.

```
      ℔ qu. lb.
      22: 1 :15
          4
         ---
         89
         28
        ---
        727
       178
       ----
       2507 lb.
s. d.  ----
6:8 ⅓ £. 835:13: 4 at 5 per Cent.
                 5
     -----------
  £. 41|78: 06 : 8    £. 41 : 15 : 8 at 5 per Ct.
        20                       5
       ----            ----------
  Sh. 15|66            £. 2|08: 18: 4
        12                 20
       ----               ----
  d.  8|00             Sh. 1|78
                             12
                            ----
                       d. 9.40
```

	l.	*s.*	*d.*
Duty	41	15	8
5 *per Cent*. off.	2	1	9.40
neat Duty.	39	13	10.60

10. What

10. What is the *neat Duty* of 96½ ⊕ at 2 *l. per* ⊕ paying *Subsidy* at 5 *per Cent.* and 5 *per Cent.* off, *Impost* at 2 *s.* 6 *d. per* ⊕ and 6¼ *per Cent.* off.

⊕ 96½
2
£. 193 at 5 *per Cent.*
5
£. 9|65
20
Sh. 13|00

l. *s.*
9 : 13 at 5 *per Cent.*
5
|48 : 05
20
Sh. 9|65
12
d. 7|80

s. *d.*
2 : 6 --- 96½
12
½ ⊕ --- 0 : 1 : 3
£. 12 : 1 : 3 at 6¼ *per Cent.*
6
£. 72 : 7 : 6
¼ ----- 3 : 0 : 3¾
|75 : 7 : 9¾
20
Sh. 15|07
12
|93¾

Subsidy *L.*	9 : 13 : 0
5 *per Cent.* off	- - 9 : 7.80
Neat Subsidy £.	9 : 3 : 4.20
Impost £.	12 : 1 : 3
6¼ *per Cent.* off	- - - 15 : 0.93¾
Neat Impost £.	11 : 6 : 2.06¼
Neat Subsidy	9 : 3 : 4.20
Neat Duty £.	20 : 9 : 6.26¼

11. What is the *Neat Duty* of 35 ⊕ 3 *qrs.* 24 *lb.* at 3 *s.* 4 *d.* per *lb.* paying *Subsidy* at 5 *per Cent.* and 5 *per Cent.* off, *Impost* at 10 *per Cent.* and $6\frac{1}{4}$ *per Cent.* off.

```
              ⊕ 35:3:24
                   4
                -----
                  143
                   28
                -----
                 1148
                 288
                -----
                 4028 lb. at 3s. 4d. per lb.
     s. d.      -----
     3:4  1/6 - |671 : 6:8 at 5 per Cent.
                          5
           ----------------
        £. 33|56:13:4      £. 33:11:4 at 5 per Ct.
               20                       5
            ------           -------------
       Sh. 11|33           £. 1|67:16:8
               12                  20
            ------           ---------
        d. 4|00           Sh. 13|56
                                   12
                                -----
                            d. 6|80

      £. 671:6:8 at 10 per Cent.
               10
       ------------
     £.67|13:6:8    £. 67 : 2 : 8 at 6 1/4 per Cent.
          20                    6
        -----        --------------
     Sh. 2|66        £. 402:16:0
          12   1/4 - - - 16:15:8
        -----        --------------
     d. 8|00         £. 4|19:11:8
                          20
                    Sh. 3|91
                          12
                       ------
                    d. 11|00
```

	l. s. d.
Subsidy	33 : 11 : 4
5 *per Cent*. off	1 : 13 : 6 . 80
Neat Subsidy	£. 31 : 17 : 9 . 20

Impost	£. 67 : 2 : 8
6 ¼ *per Cent*. off	4 : 3 : 11
Neat Impost	£. 62 : 18 : 9
Neat Subsidy	31 : 17 : 9 . 20
Neat Duty	£. 94 : 16 : 6 . 20

12. What is the *Neat Duty* of 976 *Dozen*, at 6 *l. per Dozen*, paying *old Subsidy*, and *new Subsidy*, each 5 *per Cent*. and 5 *per Cent*. off, and ⅓ *Subsidy* at 1 *l*. 13 *s*. 4 *d*. *per Cent*. and 5 *per Cent*. off.

976 *Dozen*, at 6 *l. per Dozen*.
6

5856 *l*. at 5 *per Cent*.
5

£. 292|80
20

Sh. 16|00

	l. s.
Old Subsidy	292 : 16
New Subsidy	292 : 16
⅓ Subsidy . .	97 : 12
Total Subsidy	£. 683 : 4

£. 683 : 4 at 5 *per Cent*.
5

£. 34|16 : 0
20

Sh. 3|20
12

d. 2|40

	l. s. d.
Subsidies	683 : 4 : 0
5 *per Cent*. off	34 : 3 : 2 . 40
Neat Duty	£. 649 : 0 : 9 . 60

 13. What

13. What is the *Neat Duty* of 754 ½ *hundred Dozen*, at 13 *s.* 4 *d. per hundred Dozen*; paying *Old Subsidy*, *New Subsidy*, and ⅓ and ⅔ *Subsidy*, each 5 *per Cent.* and 5 *per Cent.* off.

Note, ⅓ and ⅔ *Subsidy*, make an whole *Subsidy*.

s. d.		754 ½ at 6 *s.* 8 *d. per* hundred Dozen.
6 : 8	⅓	251 : 6 : 8
6 : 8	d°.	251 : 6 : 8
	½	. . . 6 : 8

£. 503 : 0 : 0 Old Subsidy.
503 : 0 : 0 New Subsidy.
503 : 0 : 0 ⅓ and ⅔ Subsidy.

£. 1509 : 0 : 0 at 5 *per Cent.*
5

£. 75|45 : 0 : 0
20

Sh. 9|00

l.	*s.*	
75	9	at 5 *per Cent.*
	5	

£. 3|77 : 5
20

Sh. 15|45
12

d. 5|40

Boo [redacted]

Subsidies	£.	75 : 9 : 0
5 *per Cent.* off		3 : 15 : 5 . 40
Neat Duty	£.	71 : 13 : 6 . 60

SQUARE

SQUARE *and* CUBE ROOT.

I Shall in this Place fix the Extraction of the *Square* and *Cube* Roots; because in Practice it very seldom happens, that the Number of which the *Square* and *Cube* Root is required, proves an exact *Square* or *Cube*, and therefore the *Root* is imperfect; but by the Use of a *Decimal*, we may approach as near thereunto, so as to want so little of Exactness, as may be very well deemed as nothing.

The following Table gives you the true *Square* and *Cube*, from an *Unit* to *Nine*, which is all that need be committed to the Memory.

Roots.	Squares.	Cubes.
1	1	1
2	4	8
3	9	27
4	16	64
5	25	125
6	36	216
7	49	343
8	64	512
9	81	729

To extract the *Square* Root of any Sum or Number, the first Thing to be done, is to place a *Period*, or any other Note of Distinction, over the last Figure; then leaving *one* Figure, place another over the next, and so proceed, leaving *one* Figure, till you have gone through the whole, the Number of these *Periods* shew you of how many Figures the *Root* consists. Then seek the nearest *Square* to the *first Period*, and subtract it therefrom, and bring down the next two Figures thereto, which gives a *Dividend*. Now to find a *Divisor* thereto, you

you muſt multiply the *Root* by 2, then ſee how often that *Diviſor* is contained in the *Dividend*, without regarding the *Units* thereof, and place the ſame to the *Root*. To find the *Subtrahend*, multiply the *Diviſor* with the *laſt* Figure in the *Root* annexed, by the *laſt* Figure in the *Root*, and bring down the *two* next Figures to the *Remainder*, which will give a new *Dividend*, then proceed as before, till the *Root* is finiſhed. An *Example* or two will render theſe Inſtructions more plain.

Note: When your Work is ended, if there be any *Remainder*, by the bringing down *two Cyphers*, and proceeding thereupon, you will have a *true Root* to the *tenth* Part of an *Unit*, and if you proceed to bring down *two Cyphers* more, it will be a true Root to the *hundredth Part* of an *Unit*, and ſo on, you may have a *true Root* to the *thouſandth* and *ten thouſandth* Part of an *Unit*, or to what Exactneſs you pleaſe.

```
2   3 7 2 8
 √13897984
  9
 67|489
    469
 742|2079
     1484
 7448|59584
      59584
          0
```

```
2   1 3 3 8 9 7. 2
 √17928467958.00
  1
 23|79
    69
 263|1028
      789
 2668|23946
      21344
 26769|260279
       240921
 267787|1935858
        1874509
 2677942|6134900
         5355884
          779116
```

```
                2 5 9 8 8 5 5.0 8 5
               √ 358627412975.000000
                 25
             109|1086
                  981
            1188|10527
                  9504
           11968|102341
                  95744
          119765|0659729
                  598825
         1197705|6090475
                  5988525
       119771008|1019500000
                  958168064
     11977101165|6133193600
                  5988550825
                   144642775
```

The *Root* ſquared with the *Remainder*, if any, added thereunto, proves the Truth of the Operation, as exemplified in this laſt *Example*.

```
                 598855.085
                 598855.085
                 2994275425
                4790840680
              29942754250
             2994275425
            4790840680
           4790840680
          5389695765
         2994275425
          Rem.... 144642775
Square, 358627412975.000000
```

To extract the *Cube Root* of any Sum or Number. First, place a *Period* over the *last* Figure; then leaving *two* Figures, point the next, and so on, to the End; then seek the nearest *Cube*, to the first Point, and subtract it therefrom; bring down the next *three* Figures to the *Remainder*, it gives you a *Dividend*.

To find a *Divisor* thereto. Multiply the Square of the *Root* by 3; then see how often the *Divisor* is contained in the *Dividend*, when two Figures, *viz.* the *Units* and *Tens*, are rejected, and place the same in the *Root*.

To find the *Subtrahend*.

1. *Cube* the last Figure placed in the *Root*.

2. Multiply the *Triple* of all the Figures, except the *last*, by the *Square* of the last.

3. Multiply the *Divisor* by the *last* Figure.

These three *Products*, rightly placed, and added together, gives the *Subtrahend*.

Note, By adding three *Cyphers* to the Remainder, you may proceed, and obtain a true *Root* to the 10th, 100th, 1000th Part of an *Unit*, or nearer, if you please.

Note by adding three Cyphers
to the ~~Remainder~~

```
                   8   3   6   9
               √586166107409
Near est Cube   512
               ————————
              192|74166        Took the Sq. 64 is 8 Root
               ————————
                     27
                   216
                  576
                 ——————
                  59787
                 ——————
           20667|14379107
                 ——————
                      216
                    8964
                  124002
                 ————————
                  12490056
                 ————————
       2096688| 18890051409
                 ——————————
                         729
                    203148
                 18870192
                 ——————————
                 18890051409
                 ——————————
                          0
```

```
            ,4 2 0 3 3·9
          √74267948297643.000
            64
         48|10267
               08
              48
             96
            10088
     529200|179948297
                   27
               11340
           1587600
           158873427
   52996627|210748706 43
                        27
                 113481
           158986881
           15899822937
 5300319267|51750477 06000
                      729
               10214019
          477028 73403
          477038 9481219
            404658224781
```

2 1 3 6 0 . 5 7

√974628519 7625.000000

8

12|1746

01

06

12

1261

1323|485285

27

567

3969

402597

136107|82688197

216

23004

816642

81894456

1368748800|793741625000

125

1602000

6843744000

684390420125

136881288075|109351204875000

343

31399935

958169016525

95817215652193

13533989222807

The Root *cubed*, with the *Remainder*, if any, added thereunto, proves the Truth of the Operation, as exemplified in this last Example.

	21360.57
	21360.57
	14952399
	10680285
	128163420
	6408171
	2136057
	4272114
Square	456273950.7249
	21360.57
	31939176550743
	22813697536245
	273764370434940
	13688218521747
	4562739507249
	9125479014498
Remainder	13533989222807
Cube	9746285197625.000000

If the *Biquadratic Root* of any Number be required; first extract the *Square Root* of that Number, and then extract the *Square Root* of that *Root*, it will give the *Biquadratic Root* of the given Number.

I shall leave the Reader to exemplify it.

Thus having briefly run through as much as is necessary in *Decimal Fractions*, I shall proceed to *Vulgar Fractions*, wherein the Examples in *Addition*, &c. shall be *decimally* performed, which will be of great Advantage to the Learner, to lead him into a right Understanding, and true Knowledge of this excellent Rule of *Decimal Arithmetic*.

VULGAR

VULGAR FRACTIONS

ARE of three Kinds, *viz. Proper, Improper,* and *Compound.*

A *Proper Fraction* is that which is lefs than an *Unit,* and therefore its *Numerator* is lefs than its *Denominator.* As $\frac{3}{4}$ $\frac{4}{5}$ $\frac{7}{8}$ are *Proper Fractions.*

An *Improper Fraction* is that which is greater than an *Unit,* and therefore its *Numerator* is greater than its *Denominator.* As $\frac{4}{3}$ $\frac{5}{4}$ $\frac{8}{7}$ are *Improper Fractions.*

A *Compound Fraction* is a *Fraction* of a *Fraction,* confifting of feveral *Numerators* and *Denominators,* connected together with the Word *of* between them. As $\frac{2}{3}$ of $\frac{3}{4}$ and $\frac{4}{5}$ of $\frac{5}{6}$ of $\frac{11}{12}$ are *Compound Fractions.*

Note: If the *Numerator* and *Denominator* of a *Fraction* be equal, then that *Fraction* is equal to *Unity.* As $\frac{5}{5}$ $\frac{3}{3}$ $\frac{6}{6}$ are each equal to an *Unit.*

REDUCTION *of* FRACTIONS

DIfcovereth the principal Knowledge of *Fractions,* and is contained under *five* feveral Heads, *viz.*

1. To reduce *Improper Fractions* into *Integers.*
2. To reduce *Compound Fractions* to *Proper Fractions.*
3. To reduce *Integers* into the Form of *Fractions.*
4. To reduce *Fractions* into their *leaft* Terms.
5. To reduce *Fractions* of different Denominators, into *Fractions* of the fame Denominator.

To

To reduce Improper FRACTIONS *into Integers.*

RULE.

DIvide the *Numerator* by the *Denominator*, the *Quotient* gives the *Integers*.

Example.

Reduce $\frac{15}{4}$ $\frac{108}{3}$ $\frac{379}{22}$ $\frac{4796}{119}$ into Integers.

$$\frac{15}{4}\ 4)\,15\,(3\tfrac{3}{4} \quad 3 \qquad \frac{108}{3}\ 3)\,108\,(36 \quad 0 \qquad \frac{379}{22}\ 22)\,379\,(17\tfrac{5}{22} \quad 5 \qquad \frac{4796}{119}\ 119)\,4796\,(40\tfrac{36}{119} \quad 36$$

Thus $\frac{15}{4}$ reduced is $3\frac{3}{4}$. $\frac{108}{3}$ is 36. $\frac{379}{22}$ is $17\frac{5}{22}$ &c.

To reduce Compound Fractions to Proper Fractions.

RULE.

MUltiply all the *Numerators* together for a new *Numerator*, and all the *Denominators* together for a new *Denominator*.

Example.

Reduce $\frac{2}{3}$ of $\frac{3}{4}$ $\frac{7}{8}$ of $\frac{8}{9}$ $\frac{3}{5}$ of $\frac{2}{3}$ of $\frac{11}{12}$

and $\frac{1}{2}$ of $\frac{3}{4}$ of $\frac{5}{9}$ of $\frac{2}{11}$ into *Proper Fractions*.

$$\overset{6}{\overline{\underset{12}{\underline{\tfrac{2}{3}\text{ of }\tfrac{3}{4}}}}} \qquad \overset{56}{\overline{\underset{72}{\underline{\tfrac{7}{8}\text{ of }\tfrac{8}{9}}}}} \qquad \overset{66}{\overline{\underset{180}{\underline{\tfrac{3}{5}\text{ of }\tfrac{2}{3}\text{ of }\tfrac{11}{12}}}}}$$

$$\overset{30}{\overline{\underset{792}{\underline{\tfrac{1}{2}\text{ of }\tfrac{3}{4}\text{ of }\tfrac{5}{9}\text{ of }\tfrac{2}{11}}}}}$$

Thus $\frac{2}{2}$ of $\frac{3}{4}$ is $\frac{6}{12}$ and $\frac{7}{8}$ of $\frac{8}{9}$ is $\frac{56}{72}$ *&c.*

To reduce Integers into the Form of FRACTIONS.

UNDER this Head there are three Cafes.

1. If the *Integer* have no *affigned Denominator*.
2. If the *Integer* have an *affigned Denominator*.
3. If the *Integer* have a *Fraction* annexed.

Cafe 1. If the *Integer* have no *affigned Denominator*.

RULE.

An *Unit* fubfcribed muft be the *Denominator*.

Example. Reduce 7 : 12 : 56 : 248 : into the Form of *Fractions*,

Thus, $\frac{7}{1}$ $\frac{12}{1}$ $\frac{56}{1}$ $\frac{248}{1}$.

Cafe 2. If the *Integer* have an *affigned Denominator*.

RULE.

Multiply the *Integer* by the *affigned Denominator*, the *Product* is the *Numerator* to the *affigned Denominator*.

Example 1. Reduce 9 into the Form of a *Fraction* whofe *Denominator* fhall be 8.

Example 2.

Example 2. Reduce 19, whose *Denominator* shall be 11.

Example 3. Reduce 21, whose *Denominator* shall be 12.

9 multiplied by 8 is 72; that is, $\frac{72}{8}$

19 multiplied by 11 is 209; that is, $\frac{209}{11}$

21 multiplied by 12 is 252; that is, $\frac{252}{12}$

Now if these *Improper Fractions* $\frac{78}{8}$ $\frac{209}{11}$ $\frac{252}{12}$ be reduced into *Integers*, they will produce 9. 19. 21, and prove the Truth of the Operations.

Case 3. If the *Integer* have a *Fraction* annexed.

RULE.

Multiply the *Integer* by the *Denominator*, and add thereto the *Numerator*. The Sum is the *Numerator* to the *Denominator* of the *annexed Fraction*.

Example. Reduce $7\frac{7}{8}$ $21\frac{19}{27}$ $119\frac{35}{38}$ into *Improper Fractions*.

$$\begin{array}{c} 63 \\ \hline 7\frac{7}{8} \\ \hline 8 \end{array} \qquad \begin{array}{c} 586 \\ \hline 21\frac{19}{27} \\ \hline 27 \end{array} \qquad \begin{array}{c} 4557 \\ \hline 119\frac{35}{58} \\ \hline 38 \end{array}$$

Reduce $\frac{63}{8}$ $\frac{586}{27}$ $\frac{4557}{38}$ into *Integers*, it will prove the Truth of the Operations.

To

To reduce FRACTIONS *into their leaſt Terms.*

THIS by ſome is called *Abbreviation* of *Fractions*, and is beſt performed by the *greateſt Common Meaſure.*

The *greateſt Common Meaſure* is a certain Number, that will divide both *Numerator* and *Denominator* without any *Remainder*, and by that Means reduce the *Fraction* into its *loweſt* Terms at once, and is found by the following Rule.

RULE.

Divide the *Denominator* by the *Numerator*, and then the *Numerator* by the *Remainder*, and ſo proceed, dividing the *laſt Diviſor* by its *Remainder*, till either *Nothing* or an *Unit* remains. If *Nothing* remain, the *laſt Diviſor* is the *greateſt Common Meaſure*; but if an *Unit*, the *Fraction* is in its loweſt Terms already.

Example. Reduce $\frac{1080}{1944}$ $\frac{424}{536}$ $\frac{129}{3271}$ into their loweſt Terms.

```
      1080                       216|1080|5
     ------                          1080
 1080|1944|1                         ----
     ------                      216|1944|9
       864|1080|1                    1944
           ------                    ----
The greateſt 216|864|4                 0
  Common         -----
  Meaſure          0
```

Therefore $\frac{1080}{1944}$ reduced into its loweſt Terms is $\frac{5}{9}$

```
      424                                  8
424|536|1                              424|53
   112|424|3                           536|67
        88|112|1
           24|88|3
              16|24|1
The greatest Com. Mea. 8|16|2
                          0
```

Therefore $\frac{424}{536}$ reduced into its lowest Terms is $\frac{53}{67}$.

```
      129
129|3271|25
       46|129|2
        37|46|1
            9|37|4
                1
```

Therefore $\frac{129}{3271}$ is in its lowest Terms already.

Note: If *Cyphers* are annexed to the *Numerator* and *Denominator*, by cutting off a like Number from both, the *Fraction* will be abbreviated thereby: As $\frac{200}{300}$ will be $\frac{2}{3}$, and $\frac{270}{400}$ will be $\frac{27}{40}$, *&c.*

Also *Fractions* may be abbreviated, by dividing them by a *Common Measure*, again and again, till they are reduced into their lowest Terms.

```
    2     2     2     3    9
1080|540|270|135|45|5
1944|972|486|243|81|9
```

To

To reduce FRACTIONS *of different Denominators into* FRACTIONS *of the same Denominator.*

RULE.

MUltiply all the *Denominators* together for a *Common Denominator*, and each *Numerator* into every *Denominator*, except its own, for *New Numerators*.

1. Reduce $\frac{7}{8}$ and $\frac{5}{6}$ into *Fractions* of the same *Denominator*.

$$\begin{array}{cc} 42 & 40 \\ \hline \frac{7}{8} & \frac{5}{6} \\ \hline \multicolumn{2}{c}{48} \end{array}$$

First. The two *Denominators* 8 and 6, multiplied together, gives 48 for a *Common Denominator*, and then the *Numerator* 7 by the *Denominator* 6 for a *New Numerator* to the first *Fraction*, and the *Numerator* 5 by the *Denominator* 8 for a *New Numerator* to the second *Fraction*; so that the *Fractions* $\frac{7}{8}$ and $\frac{5}{6}$, reduced as was required, becomes $\frac{42}{48}$ and $\frac{40}{48}$, which are equal to $\frac{7}{8}$ and $\frac{5}{6}$.

From hence, if it be necessary to know which of *two* or more *Fractions* is the greatest, let them be reduced into *Fractions* of the same *Denominator*, and that *Fraction* which hath the greatest *Numerator* is the *greatest Fraction*.

2. Reduce $\frac{2}{3}$ $\frac{3}{4}$ $\frac{4}{5}$ $\frac{5}{6}$ $\frac{7}{8}$ into *Fractions* of the same *Denominator*.

$$\begin{array}{ccccc} 1920 & 2160 & 2304 & 2400 & 2520 \\ \hline \frac{2}{3} & \frac{3}{4} & \frac{4}{5} & \frac{5}{6} & \frac{7}{8} \\ \hline \multicolumn{5}{c}{2880} \end{array}$$

$$\begin{array}{r} 4 \\ 3 \\ \hline 12 \\ 4 \\ \hline 48 \\ 6 \\ \hline 288 \\ 8 \\ \hline 2304 \end{array} \quad \begin{array}{r} 3 \\ 3 \\ \hline 9 \\ 5 \\ \hline 45 \\ 6 \\ \hline 270 \\ 8 \\ \hline 2160 \end{array} \quad \begin{array}{r} 2 \\ 4 \\ \hline 8 \\ 5 \\ \hline 40 \\ 6 \\ \hline 240 \\ 8 \\ \hline 1920 \end{array} \quad \begin{array}{r} 3 \\ 4 \\ \hline 12 \\ 5 \\ \hline 60 \\ 6 \\ \hline 360 \\ 8 \\ \hline 2880 \end{array}$$

2880 *Common Denominator.*

1920 *Numerator* to the first *Fraction.*

2160 *Numerator* to the second *Fraction.*

2304 *Numerator* to the third *Fraction.*

$$\begin{array}{r} 7 \\ 3 \\ \hline 21 \\ 4 \\ \hline 84 \\ 5 \\ \hline 420 \\ 6 \\ \hline 2520 \end{array} \quad \begin{array}{r} 5 \\ 3 \\ \hline 15 \\ 4 \\ \hline 60 \\ 5 \\ \hline 300 \\ 8 \\ \hline 2400 \end{array}$$

2400 *Numerator* to the fourth *Fraction.*

2520 *Numerator* to the fifth *Fraction.*

If $\frac{1920}{2880}$ $\frac{2160}{2880}$ $\frac{2304}{2880}$ $\frac{2400}{2880}$ $\frac{2520}{2880}$ be reduced into their *least Terms*, they will produce $\frac{2}{3}$ $\frac{3}{4}$ $\frac{4}{5}$ $\frac{5}{6}$ $\frac{7}{8}$, and prove the Truth of the Operation.

3. Reduce $\frac{2}{3}$ of $\frac{3}{4}$ $\frac{5}{6}$ of $\frac{7}{8}$ and $\frac{2}{9}$ of $\frac{11}{12}$ into *Fractions* of the same *Denominator*.

$$\begin{array}{ccc} 6 & 35 & 22 \\ \hline \frac{2}{3} \text{ of } \frac{3}{4} & \frac{5}{6} \text{ of } \frac{7}{8} & \frac{2}{9} \text{ of } \frac{11}{12} \\ \hline 12 & 48 & 108 \end{array}$$

$$\begin{array}{ccc} 2592 & 3780 & 1056 \\ \hline \frac{1}{2} & \frac{35}{48} & \frac{11}{54} \\ \hline & 5184 & \end{array}$$

Having first reduced the *Compound Fractions* to *Proper Fractions*, they produce $\frac{6}{12}$ $\frac{35}{48}$ and $\frac{22}{108}$. Then $\frac{6}{12}$ and $\frac{22}{108}$ being reduced into their *least Terms*, produce $\frac{1}{2}$ and $\frac{11}{54}$. Then $\frac{1}{2}$ $\frac{35}{48}$ and $\frac{11}{54}$ reduced into *Fractions* of the same *Denominator*, produce $\frac{2592}{5184}$ $\frac{3780}{5184}$ $\frac{1056}{5184}$ as above.

4. Reduce $3\frac{3}{4}$ $7\frac{7}{8}$ $9\frac{5}{6}$ into *Fractions* of the same *Denominator*.

$$\begin{array}{ccc} 15 & 63 & 59 \\ \hline 3\frac{3}{4} & 7\frac{7}{8} & 9\frac{5}{6} \\ \hline 4 & 8 & 6 \end{array}$$

$$\begin{array}{ccc} 720 & 1512 & 1888 \\ \hline \frac{15}{4} & \frac{63}{8} & \frac{59}{6} \\ \hline & 192 & \end{array}$$

In this *Example*, the *Integers* with the *Fractions* annexed are first reduced into *Improper Fractions*, and

and then the *Improper Fractions* reduced into *Fractions* of the ſame *Denominator*, as the *Example* plainly ſheweth.

5. Reduce $7\frac{7}{8}$ $\frac{2}{3}$ of $\frac{5}{9}$ $\frac{11}{12}$ and 9 into *Fractions* of the ſame *Denominator*.

$$\frac{63}{\dfrac{7\frac{7}{8}}{8}} \qquad \frac{10}{\dfrac{\frac{2}{3}\text{ of }\frac{5}{9}}{27}}$$

$$\frac{20412 \qquad 960 \qquad 2376 \qquad 23328}{\dfrac{\frac{63}{8} \qquad \frac{10}{27} \qquad \frac{11}{12} \qquad \frac{9}{1}}{2592}}$$

What hath hitherto been done in Reduction of *Fractions*, is chiefly to fit and prepare *Fractions* for *Addition*, *Subtraction*, *Multiplication*, and *Diviſion*, as Occaſion requires, and will, as we go on, plainly appear.

ADDITION of FRACTIONS.

RULE.

IF the *Denominators* are equal, add the *Numerators* together; but if the *Denominators* be unequal, reduce them into *Fractions* of the ſame *Denominator*, and add the *New Numerators* together.

1. Add

1. Add $\frac{2}{19}$ $\frac{3}{19}$ $\frac{4}{19}$ and $\frac{7}{19}$ together.

$$\begin{array}{cccc} & 16 & & \\ \hline \frac{2}{19} & \frac{3}{19} & \frac{4}{19} & \frac{7}{19} \\ \hline & 19 & & \end{array}$$

The Total is $\frac{16}{19}$.

2. Add $\frac{1}{5}$ $\frac{2}{5}$ $\frac{3}{5}$ and $\frac{4}{5}$ together.

$$\begin{array}{cccc} & 10 & & \\ \hline \frac{1}{5} & \frac{2}{5} & \frac{3}{5} & \frac{4}{5} \\ \hline \end{array}$$

$$5|10|2$$
$$0$$

The Total is $\frac{10}{5}$, which reduced into *Integers*, is 2.

3. Add $\frac{3}{13}$ $\frac{4}{13}$ $\frac{11}{13}$ and $\frac{12}{13}$ together.

$$\begin{array}{cccc} & 30 & & \\ \hline \frac{3}{13} & \frac{4}{13} & \frac{11}{13} & \frac{12}{13} \\ \hline \end{array}$$

$$\begin{array}{r} 13|30|\ 2\frac{4}{13} \\ 26 \\ \hline 4 \end{array}$$

The Total is $\frac{30}{13}$, which reduced into *Integers*, is $2\frac{4}{13}$.

4. Add $\frac{7}{8}$ $\frac{8}{9}$ $\frac{3}{4}$ $\frac{5}{6}$ together *Fractionally* and *Decimally*.

$$\begin{array}{cccc} & 5784 & & \\ \hline 1512 & 1536 & 1296 & 1440 \\ \hline \frac{7}{8} & \frac{8}{9} & \frac{3}{4} & \frac{5}{6} \\ \hline \end{array} \qquad \begin{array}{r} 1512 \\ 1536 \\ 1296 \\ 1440 \\ \hline 5784 \end{array}$$

$$\begin{array}{r} 1728|5784|\ 3\frac{25}{72} \\ 5184 \\ \hline 600 \end{array}$$

In this *Example* the given *Fractions* having *unequal* Denominators, are first reduced into *Fractions* of the *same* Denomination, and the *new* Numerators added together makes the *total* Sum of those *Fractions* to be $\frac{5784}{1728}$ an *improper* Fraction, which being reduced into *Integers*, gives $3\frac{25}{72}$.

Note : $\frac{25}{72}$ comes of $\frac{600}{1728}$ reduced into its least Terms.

The preceeding *Example* wrought *Decimally*.

```
7 | .875        8 | .888888        5 | .833333
8 | 7.000       9 | 8.000000       6 | 5.000000
                    Rem. 8             Rem. 2

3 | .75           .875          25 | 347222
4 | 3.00          .888888       72 | 25.000000
                  .75                Rem. 16
                  .833333
```

Total 3.347221 which agrees with the Total *fractionally*, as appears by the Operation of $\frac{25}{72}$ reduced into a *Decimal*.

5. Add $\frac{2}{3}$ of $\frac{3}{4}$ $\frac{4}{5}$ of $\frac{5}{9}$ $\frac{7}{8}$ of $\frac{11}{12}$ together *Fractionally* and *Decimally*.

$$\frac{2}{3} \text{ of } \frac{3}{4} = \frac{6}{12} = \frac{1}{2} \qquad \frac{4}{5} \text{ of } \frac{5}{9} = \frac{20}{45} = \frac{4}{9} \qquad \frac{7}{8} \text{ of } \frac{11}{12} = \frac{77}{96}$$

```
              3018
     864      768      1386
      1        4        77
      2        9        96

864
768           1728|3018| 1 1290/1728 = 215/288
1386               1728
3018               1290
```

Decimally.

Decimally,

$\frac{1}{2}\Big|\frac{.5}{1.0}$ $\qquad$ $\frac{4}{9}\Big|\frac{.444444}{4.000000}$ $\qquad$ $\frac{77}{96}\Big|\frac{.802083}{77.000000}$

Rem. 4 $\qquad$ Rem. 32

$$\begin{array}{rr} & .5 \\ & .444444 \\ & .802083 \\ \hline \text{Total} & 1.746527 \end{array}$$

$\frac{215}{288}\Big|\frac{.746527}{215.000000}$

Rem. 224

6. Add $7\frac{7}{8}$ $3\frac{3}{4}$ $5\frac{1}{5}$ together *Fractionally* and *Decimally*.

$$\frac{63}{7\frac{7}{8}} \quad \frac{15}{3\frac{3}{4}} \quad \frac{26}{5\frac{1}{5}}$$
$$8 \quad 4 \quad 5$$

$$\begin{array}{r} 1260 \\ 600 \\ 832 \\ \hline 2692 \end{array}$$

$$\frac{2692}{1260 \quad 600 \quad 832}$$

$$\frac{63}{8} \quad \frac{15}{4} \quad \frac{26}{5}$$

$160)2692(16\frac{132}{160} = \frac{33}{40}$

Rem. 132

Decimally.

$\frac{7}{8}\Big|\frac{.875}{7.000}$ $\qquad$ $\frac{3}{4}\Big|\frac{.75}{3.00}$ $\qquad$ $\frac{1}{5}\Big|\frac{.2}{1.0}$

$$\begin{array}{rr} & 7.875 \\ & 3.75 \\ & 5.2 \\ \hline \text{Total} & 16.825 \end{array}$$

$\frac{33}{40}\Big|\frac{.825}{33.000}$

Note: This Example *Fractionally*, might have been wrought without reducing the *Integers*, with their *Fractions* annexed, into *Improper Fractions*; by adding only the *Fractions* together by themselves, and also the *Integers*, as you may plainly see by the following Operation.

$$\begin{array}{ccc} & 292 & \\ \hline 140 & 120 & 32 \\ \hline \frac{7}{8} & \frac{3}{4} & \frac{1}{5} \\ \hline \end{array}$$

$$160\ )\ \underline{292}\ (\ 1\ \frac{132}{160} = \frac{33}{40}$$

$$132$$

$$\begin{array}{r} 140 \\ 120 \\ \underline{32} \\ 292 \end{array} \qquad \begin{array}{r} 7 \\ 3 \\ 5 \\ \underline{1\ \frac{33}{40}} \\ 16\ \frac{33}{40} \end{array}$$

7. To $7\ \frac{7}{8}$ more $\frac{3}{80}$, add $9\ \frac{3}{4}$ more $\frac{2}{3}$ of $\frac{7}{8}$ *Fractionally* and *Decimally*.

$$\begin{array}{ccc} \overline{63} & \overline{39} & \overline{14} \\ 7\ \frac{7}{8} & 9\ \frac{3}{4} & \frac{2}{3} \text{ of } \frac{7}{8} = \frac{7}{12} \\ \overline{8} & \overline{4} & \overline{24} \end{array}$$

$$\begin{array}{cccc} & 560512 & & \\ \hline 241920 & 1152 & 299520 & 17920 \\ \hline \frac{63}{8} & \frac{3}{80} & \frac{39}{4} & \frac{7}{12} \\ \hline \end{array}$$

$$30720\ )\ \underline{560512}\ (\ 18\ \frac{59}{240}$$

$$7552$$

$$\begin{array}{r} 241920 \\ 1152 \\ 299520 \\ \underline{17920} \\ 560512 \end{array} \qquad \frac{7552}{30720} = \frac{59}{40}$$

Decimally.

$$\frac{7}{8}\Big|\frac{.875}{7.000} \qquad \frac{3}{80}\Big|\frac{.0375}{3.0000} \qquad \frac{3}{4}\Big|\frac{.75}{3.00}$$

$$\frac{7}{12}\Big|\frac{.583333}{7.000000}$$

Rem. 4

$$\begin{array}{r} 7.875 \\ .0375 \\ 9.75 \\ \underline{.583333} \\ 18.245833 \end{array}$$

$$\frac{59}{240}\Big|\frac{.245833}{59.000000}$$

80

This Sum *Fractionally*, might have been wrought by reducing the *Integers* into the Form of *Fractions*, subscribing an *Unit* for their Denominators, and then the *Fractions* to be added together, would have been $\frac{7}{1}$ $\frac{7}{8}$ $\frac{3}{80}$ $\frac{9}{1}$ $\frac{3}{4}$ $\frac{7}{12}$ as followeth.

$$\frac{560512}{215040 \quad 26880 \quad 1152 \quad 276480 \quad 23040 \quad 17920}$$

$$\frac{7}{1} \quad \frac{7}{8} \quad \frac{3}{80} \quad \frac{9}{1} \quad \frac{3}{4} \quad \frac{7}{12}$$

$$\begin{array}{r} 215040 \\ 26880 \\ 1152 \\ 276480 \\ 23040 \\ 17920 \\ \hline 560512 \end{array} \qquad 30720|560512|18\,\frac{59}{240}$$

8. To $3\frac{3}{4}l.$ and $\frac{7}{8}$ of a *Shilling*, add $9\frac{2}{9}l.$ and $\frac{1}{3}$ of a *Penny*, *Fractionally* and *Decimally*.

$$\frac{7}{\frac{7}{8} \text{ of } \frac{1}{20}} \atop 160 \qquad \frac{1}{\frac{1}{3} \text{ of } \frac{1}{240}} \atop 720 \qquad \frac{15}{3\frac{3}{4}} \atop 4 \qquad \frac{83}{9\frac{2}{9}} \atop 9$$

$$\frac{53985600}{15552000 \quad 181440 \quad 38246400 \quad 5760}$$

$$\frac{15}{4} \quad \frac{7}{160} \quad \frac{83}{9} \quad \frac{1}{720}$$

$$\begin{array}{r} 15552000 \\ 181440 \\ 38246400 \\ 5760 \\ \hline 53985600 \end{array} \qquad \begin{array}{r} 4147200)53985600(13\,l. \\ 4147200 \\ \hline 12513600 \\ 12441600 \\ \hline 72000 \\ 20 \\ \hline 1440000 \\ 12\,d. \\ \hline 4147200)17280000(4\frac{1}{6} \\ 16588800 \\ \hline 691200 \end{array}$$

$$\frac{691200}{4147200} = \frac{1}{6}$$

Decimally.

$\frac{3}{4} \big| \frac{.75}{3.00}$ $\frac{7}{160} \big| \frac{.04375}{7.00000}$ $\frac{2}{9} \big| \frac{.222222}{2.000000}$

Rem. 2

$\frac{1}{720} \big| \frac{.001388}{1.000000}$

Rem. 640

£.	3.75
	.04375
	9.222222
	.001388
£.	13.017360
	20
Sh.	.0347200
	12
Pence	4.166400

SUBTRACTION *of* FRACTIONS.

RULE.

IF the *Denominators* be equal, ſubtract the Leſſer *Numerator* from the Greater, ſo ſhall you have the *Remainder* or Difference. But if the *Denominators* be unequal, reduce them into *Fractions* of the ſame *Denominator*, and ſubtract the Leſſer new *Numerator* from the Greater.

1. From $\frac{6}{9}$ take $\frac{2}{9}$ the Remainder is $\frac{4}{9}$
2. From $\frac{11}{12}$ take $\frac{7}{12}$ the Remainder is $\frac{4}{12} = \frac{1}{3}$
3. From $\frac{7}{8}$ take $\frac{3}{4}$ *Fractionally* and *Decimally.*

$$\begin{array}{ccc} & 4 & \\ 28 & & 24 \end{array}$$

From $\frac{7}{8}$ take $\frac{3}{4}$ The Remainder is $\frac{4}{32} = \frac{1}{8}$

$$32$$

Decimally.

Decimally.

$$\frac{7}{8} = 8)\overline{7.000}\;(.875 \qquad \frac{3}{4} = 4)\overline{3.00}\;(.75$$

$$\frac{1}{8} = 8)\overline{1.000}\;(.125$$

From .875
Take .75
Rem. .125

4. From $\frac{7}{8}$ of $\frac{8}{9}$ take $\frac{2}{3}$ of $\frac{3}{8}$ *Fractionally* and *Decimally.*

56
$\frac{7}{8}$ of $\frac{8}{9} = \frac{7}{9}$
72

6
$\frac{2}{3}$ of $\frac{3}{8} = \frac{1}{4}$
24

19
28 9
From $\frac{7}{9}$ take $\frac{1}{4}$
36

Decimally.

$$\frac{7}{9} = 9)\overline{7.0000000}\;(.7777777 \qquad \text{Rem. } 7$$

$$\frac{1}{4} = 4)\overline{1.00}\;(.25$$

From .777777
Take .25
Rem. .527777

$$\frac{19}{36} = 36)\overline{19.000000}\;(.527777$$

5. From $19\frac{11}{12}$ take $7\frac{3}{80}$ *Fractionally* and *Decimally.*

12364
19120 6756
239 563
From $19\frac{11}{12}$ take $7\frac{3}{80}$

$960)\overline{12364}(12\frac{211}{240}$

Rem. 844

$\frac{844}{960} = \frac{211}{240}$

From 19120
Take 6756
Rem. 12364

Decimally.

$$\frac{11}{12}\quad 12\,|\,11.000000\,(.916666 \qquad \text{Rem. } 8$$

$$\frac{3}{80}\quad 80\,|\,3.0000\,(.0375$$

From 19.916666
Take 7.0375
Rem. 12.879166

$$\frac{211}{240}\quad 240\,|\,211.000000\,(.879166 \qquad \text{Rem. } 160$$

6. From $5\frac{3}{4}$ more $\frac{3}{80}$ take $2\frac{5}{9}$ more $\frac{2}{3}$ of $\frac{3}{4}$ *Fractionally* and *Decimally*.

$$\begin{array}{c}252\\ \hline 240 \quad 12\\ \hline \frac{3}{4}\text{ add }\frac{3}{80}=\frac{63}{80}\\ \hline 320\end{array} \qquad \begin{array}{c}6\\ \hline \frac{2}{3}\text{ of }\frac{3}{4}\\ \hline 12\end{array}=\frac{1}{2} \qquad \begin{array}{c}19\\ \hline 10 \quad 9\\ \hline \frac{5}{9}\text{ add }\frac{1}{2}\end{array}$$

$$\begin{array}{c}3934\\ \hline 8334 \quad 4400\\ \hline 463 \quad 55\\ \hline \text{From } 5\frac{63}{80} \text{ take } 3\frac{1}{18}\end{array} \qquad 18\,|\,19\,|\,1\frac{1}{18}$$

From 8334
Take 4400
Rem. 3934

$$1440\,|\,3934\,|\,2\,\frac{1054}{1440}=\frac{527}{720}$$

Decimally.

$$\frac{3}{4}\quad 4\,|\,3.00\,(.75 \qquad \frac{3}{80}\quad 80\,|\,3.0000\,(.0375 \qquad \begin{array}{r}.75\\ .0375\\ \hline .7875\end{array}$$

$$\frac{5}{9}\quad 9\,|\,5.000000\,(.555555 \quad \text{Rem. } 5 \qquad \frac{1}{2}\quad 2\,|\,1.0\,(.5 \qquad \begin{array}{r}.555555\\ .5\\ \hline 1.055555\end{array}$$

From 5.7875
Take 3.055555
Rem. 2.731945

$$\frac{527}{720}\quad 720\,|\,527.000000\,(.731944 \qquad \text{Rem. } 320$$

7. From

7. From 21 *l.* $\frac{5}{6}$ and $\frac{2}{3}$ of $\frac{3}{4}$ of a *Penny* take 9 $\frac{7}{8}$ *l.* and $\frac{1}{2}$ of a *Farthing*, *Fractionally* and *Decimally*.

6

$$\frac{2}{3}\text{ of }\frac{3}{4}\text{ of }\frac{1}{240}=\frac{1}{480}$$

2880

1

$$\frac{1}{2}\text{ of }\frac{1}{960}$$

1920

2406

2400 6

$$\frac{5}{6}\text{ add }\frac{1}{480}=\frac{401}{480}$$

2880

13448

13440 8

$$\frac{7}{8}\text{ add }\frac{1}{1920}=\frac{1681}{1920}$$

15360

11022240

20123520 9101280

10481 18961

$$\text{From } 21\frac{401}{480} \text{ take } 9\frac{1681}{1920}$$

From 20123520
Take 9101280
Rem. 11022240

92160|0|1102224|0|11 £.
88464
20
9216|0|176928|0|19 *Sh.*
1824
12
9216|21888|2 *d.*
3456
4
9216|13824|1

4608

$$\frac{4608}{9216}=\frac{1}{2}$$

Decimally.

$$\frac{5}{6}\quad 6|5.000000\,(.833333 \quad \text{Rem. } 2$$

$$\frac{1}{480}\quad 480|1.000000\,(.002083 \quad \text{Rem. } 160$$

$$\frac{7}{8}\quad 8|7.000\,(.875$$

$$\frac{1}{1920}\quad 1920|1.000000000\,(.000520833 \quad \text{Rem. } 640$$

.833333333
.002803333
.835416666

.875		£.
.000520833	From	21.835416666
.875530833	Take	9.875520833
	£.	11.959895833
		20
	Sh.	19.197916660
		12
	d.	2.374999920
		4
		1.499999680

Multiplication of FRACTIONS.

RULE.

MUltiply the *Numerators* together for the *Numerator* of the *Product*, and the *Denominators* together for the *Denominator* of the *Product*.

1. Multiply $\frac{7}{8}$ by $\frac{3}{4}$ *Fractionally* and *Decimally*.

$$\begin{array}{c} 21 \\ \hline \frac{7}{8} \quad \frac{3}{4} \\ \hline 32 \end{array}$$ the Product is $\frac{21}{32}$

Decimally.

$$7/8 \;:\; 8)7.000\,(.875 \qquad 3/4 \;:\; 4)3.00\,(.75$$

$$21/32 \;:\; 32)21.00000\,(.65625$$

$$\begin{array}{r} .875 \\ .75 \\ \hline 4375 \\ 6125 \\ \hline .65625 \end{array}$$

2. Mul-

2. Multiply $\frac{2}{3}$ of $\frac{3}{4}$ by $\frac{7}{8}$ of $\frac{5}{9}$, *Fractionally* and *Decimally*.

$$\frac{2}{3} \text{ of } \frac{3}{4} = \frac{6}{12} = \frac{1}{2} \qquad \frac{7}{8} \text{ of } \frac{5}{9} = \frac{35}{72}$$

$$\text{Mult. } \frac{1}{2} \text{ by } \frac{35}{72} \text{ the Product is } \frac{35}{144}$$

Decimally.

$$\frac{1}{2} = 1.0 \div 2 = .5 \qquad \frac{35}{72} = 35.000000 \div 72 = .486111 \quad (8)$$

Mult. .486111
by .5
.2430555

$$\frac{35}{144} = 35.000000 \div 144 = .2430555 \quad \text{Rem. } 80$$

3. Multiply $7\frac{7}{8}$ by $3\frac{3}{4}$ *Fractionally* and *Decimally*.

$$\text{Mult. } 7\frac{7}{8} = \frac{63}{8} \text{ by } 3\frac{3}{4} = \frac{15}{4}; \quad \frac{945}{32} = 29\frac{17}{32} \text{ Product.}$$

Decimally.

$$\frac{7}{8} = 7.000 \div 8 = .875 \qquad \frac{3}{4} = 3.00 \div 4 = .75$$

Mult. 7.875
by 3.75
Product 29.53125

$$\frac{17}{32} = 17.00000 \div 32 = .53125$$

4. Multiply $7\frac{7}{8}$ more $\frac{2}{3}$ of $\frac{5}{9}$ by $9\frac{11}{12}$ more $\frac{3}{80}$ *Fractionally* and *Decimally*.

$$\frac{2}{3} \text{ of } \frac{5}{9} = \frac{10}{27}$$

$$\frac{7}{8} \text{ add } \frac{10}{27} = \frac{189 + 80}{216} = \frac{269}{216}$$

$$216)269(1\frac{53}{216}$$
$$53$$

$$\frac{11}{12} \text{ add } \frac{3}{80} = \frac{880 + 36}{960} = \frac{916}{960} = \frac{229}{240}$$

$$\text{Mult. } 8\frac{53}{216} \text{ by } 9\frac{229}{240}$$

$$1781 \times 2839 = 4254809$$

$$51840)4254809(82\frac{3929}{51840}$$
$$3929$$

Decimally.

$$\frac{7}{8}: \quad 8)7.000(.875$$

$$\frac{10}{27}: \quad 27)10.000000(.370370 \quad \text{Rem. } 100$$

$$.875 + .37037 = 1.24537$$

$$\frac{11}{12}: \quad 12)11.000000(.916666 \quad \text{Rem. } 8$$

$$\frac{3}{80}: \quad 80)3.0000(.0375$$

$$.916666 + .0375 = .954166$$

$$\begin{array}{r} \text{Mult. } 9.9541666 \\ \text{by} - - - 8.24537 \\ \hline 82.07578658642 \end{array}$$

$$\frac{3929}{51840}: \quad 51840)3929.00000(.07579$$

5. Multiply $7\frac{1}{2}$ *d.* by $5\frac{1}{4}$ *d.* *Fractionally* and *Decimally*.

Note: This *Example* admits of three different Solutions, becauſe either a *Penny*, a *Shilling*, or a *Pound*, may be the *Integer*, as will appear in the following Operations.

Firſt,

First, Let a *Penny* be *Integer*.

$$\text{Mult. } \overset{\overset{315}{\overline{15 \quad\quad 21}}}{\overline{7\tfrac{1}{2} \text{ by } 5\tfrac{1}{4}}}$$

$$8|315|39 \text{ Pence.}$$

$$3$$

$$4 \text{ Farthings.}$$

$$8|12|1\tfrac{4}{8} = \tfrac{1}{2}$$

$$4$$

Decimally. *Pence.*

$$\frac{1}{2}\Big| \begin{array}{l} .5 \\ 1.0 \end{array} \qquad \frac{1}{4}\Big| \begin{array}{l} .25 \\ 1.00 \end{array}$$

Mult.	5.25
by - -	7.5
d.	39.375
	4
f.	1.500

Secondly, Let a *Shilling* be *Integer*.

$7\frac{1}{2}d.$ is 30 Farthings; that is, $\frac{30}{48}$ or $\frac{5}{8}$ of a Shilling.

$5\frac{1}{4}d.$ is 21 Farthings; that is, $\frac{21}{48}$ or $\frac{7}{16}$ of a Shilling.

$$\text{Mult. } \overset{35}{\overline{\tfrac{5}{8} \text{ by } \tfrac{7}{16}}}$$

$$128|35$$

$$12$$

$$128|420|3 \text{ Pence.}$$

$$36$$

$$4 \text{ Farthings.}$$

$$128|144|1\tfrac{16}{128} = \tfrac{1}{8}$$

$$16$$

Decimally. *Sh.*

$\frac{5}{8}$ | 5.000 (.625 $\qquad$ $\frac{7}{16}$ | 7.0000 (.4375

$\frac{1}{8}$ | 1.000 (.125

Mult.	.4375
by -	.625
	.2734375
	12
Pence.	3.2812500
	4
Farth.	1.1250000

Thirdly, Let a *Pound* be the *Integer.*

30 *Farthings* is $\frac{30}{960}$ or $\frac{1}{32}$ of a *Pound.*

21 *Farthings* is $\frac{21}{960}$ or $\frac{7}{320}$ of a *Pound.*

$$\frac{7}{\text{Mult. } \frac{1}{32} \text{ by } \frac{7}{320}}$$

10240 | 7
20
140
12
1680
4
6720

The Product is $\frac{7}{10240}$ of a *Pound*, which is $\frac{6720}{10240}$ or $\frac{21}{32}$ of a *Farthing.*

Decimally.

Decimally.

$$\frac{1}{32} \quad 32)1.00000(.03125 \qquad \frac{7}{320} \quad 320)7.000000(.021875$$

$$\frac{21}{32} \quad 32)21.00000(.65625$$

Mult. .021875
by - - .03125

.00068359375
20

.01367187500
12

.16406250000
4

.65625000000

From hence you ſee the three different Solutions of this *Example.*

	d.	f.
If a *Penny* be *Integer*, the *Product* is	39	$1\frac{1}{8}$
If a *Shilling* be *Integer* - - - - - -	3	$1\frac{1}{8}$
If a *Pound* be *Integer* - - - - - - - -		$0\frac{21}{32}$

6. Multiply 6 *s.* $7\frac{3}{4}$ *d.* by 9 *s.* $4\frac{1}{2}$ *d.* *Fractionally* and *Decimally.*

This *Example* admits of two different Solutions; either a *Shilling* or a *Pound* being *Integer.*

Firſt, Let a *Shilling* be *Integer.*

$7\frac{3}{4}$ *d.* is 31 *Farthings*; that is, $\frac{31}{48}$ of a *Shilling.*

$4\frac{1}{2}$ *d.* is 18 *Farthings*; that is, $\frac{18}{48}$ or $\frac{3}{8}$ of a *Shilling.*

$$\frac{23925}{\dfrac{319 \times 75}{\text{Mult. } 6\frac{31}{48} \text{ by } 9\frac{3}{8}}}$$

384|23925|62 *Sh.*
117
12
384|1404|3 *d.*
252
4 *f.*
384|1008|2 $\frac{240}{384} = \frac{5}{8}$
240

Decimally.

$\frac{31}{48}$ 48|31.000000 (.645833) $\frac{3}{8}$ 8|3.000 (·375)

	Sh.
Mult.	6.645833
by - - -	9.375
Sh.	62.304684375
	12
d.	3.656212500
	4
f.	2.624850000

Secondly, Let a *Pound* be *Integer*.

6 *s.* 7$\frac{3}{4}$ is 319 *Farthings*; that is, $\frac{319}{960}$ of a £.
9 *s.* 4$\frac{1}{2}$ *d.* is 450 *Farthings*; that is, $\frac{450}{960}$ or $\frac{15}{32}$ of a £.

$$\begin{array}{r} 4785 \\ \hline \end{array}$$

Mult. $\frac{319}{960}$ by $\frac{15}{32}$

$$\begin{array}{l} 30720|4785 \\ \quad\quad\quad\quad 20 \\ \hline 3072|0|9570|0|3 \; \textit{Sh.} \\ \hline \quad\quad\quad 354 \\ \quad\quad\quad\; 12 \\ \hline 3072|4248|1 \; \textit{Penny.} \\ \hline \quad\quad\quad 1176 \\ \quad\quad\quad\quad 4 \\ \hline 3072|4704|1 \frac{1632}{3072} = \frac{17}{32} \\ \hline \quad\quad\quad 1632 \end{array}$$

Decimally.

$$\begin{array}{l} 319 \quad .33229166 \\ \hline 960|319.00000000 \\ \hline \quad\quad 640 \end{array} \qquad \begin{array}{l} 15 \quad .46875 \\ \hline 32|15.00000 \end{array}$$

$$\begin{array}{lr} & \pounds. \\ \text{Mult.} & .33229166 \\ \text{by} & .46875 \\ \hline & .1557617156250 \\ & 20 \\ \hline \textit{Sh.} & 3.1152343125000 \\ & 12 \\ \hline \textit{Penny} & 1.3828117500000 \\ & 4 \\ \hline \textit{Farth.} & 1.5312470000000 \end{array}$$

	s.	d.	f.
Thus you fee, if a *Shilling* be *Integer*, the Product is - - - -	62	3	2 $\frac{1}{8}$
If a *Pound* be *Integer* - - - - -	3	1	1 $\frac{17}{32}$

7. Multiply 12 *l.* 16 *s.* 4 *d.* by 22 *l.* 16 *s.* 8 ½ *d.* *Fractionally* and *Decimally*.

16 *s.* 4 *d.* is 196 *Pence*; that is, $\frac{196}{249}$ or $\frac{49}{60}$ of a £.
16 *s.* 8 ½ *d.* is 802 *Farthings*; that is, $\frac{802}{960}$ or $\frac{401}{480}$ of a £.

$$\frac{8429009}{769 \times 10961}$$

Mult. $12\frac{49}{60}$ by $22\frac{401}{480}$

28800)8429009(292 £.
19409
20
2880|0)38818|0(13 *Sh.*
1378
12
2880)16536(5 *d.*
2136
4
2880)8544(2 $\frac{29}{30}$
2784

$\frac{2784}{2880} = \frac{29}{30}$

Decimally.

$\frac{49}{60}$ 60)49.000000(.816666
40

$\frac{401}{480}$ 480)401.0000000(.8354166
320

£.
Mult. 22.8354166
by - - 12.816666

£. 292.67390830205556
20
Sh. 13.47816604111120
12
Pence 5.73799249333440
4
Farth. 2.95196997333760

8. Mul-

8. Multiply $3\frac{3}{5}$ *l.* and $\frac{7}{9}$ of a *Shilling* by $2\frac{1}{2}$ *l.* and $\frac{3}{4}$ of $\frac{4}{5}$ of a *Penny*, both by *Vulgar* and *Decimal* Fractions.

7

$\frac{7}{9}$ of $\frac{1}{20}$

180

575

540 35

$\frac{3}{5}$ add $\frac{7}{180} = \frac{23}{36}$

900

12

$\frac{3}{4}$ of $\frac{4}{5}$ of $\frac{1}{140} = \frac{1}{140}$

4800

402

400 2

$\frac{1}{2}$ add $\frac{1}{400} = \frac{201}{400}$

800

131121

131 × 1001

Mult. $3\frac{23}{36}$ by $2\frac{201}{400}$

14400)131131(9 £.

1531

20

1440|0)3052|0(2 *Sh.*

182

12

1440)2184(1 *Penny.*

744

4

1440)2976($2\frac{1}{15}$ *f.*

96

$\frac{96}{1440} = \frac{1}{15}$

Decimally.

3 .6

5|3.0

7 .038888

180|7.000000

160

.038888

.6

.638888

1 .5

2|1.0

1 .0025

400|1.0000

.0025

.5

.5025

	£.	
Mult.	3.63888888	
	2.5025	
£.	9.106319421200	
	20	
Sh.	2.126388424000	
	12	
Penny	1.516661088000	
	4	
Farth.	2.066644352000	

The ingenious Mr. *Hodgſon*, in his *Syſtem of Mathematicks*, Vol. I. p. 21. ſays, That he cannot omit taking Notice of a very notorious Blunder, or rather Error in Judgment, that prevails amongſt almoſt all the Teachers of Arithmetic, *viz.* that of multiplying *Money* by *Money*, the Reſult of which they call *Money*, which is in its own Nature abſurd; and after his Way of reaſoning, concludes, That if the Product ariſing from the Multiplication of 4 Pounds by 4 Pounds, be 16 Pounds, then it follows, that 4 p is equal to 4 pp (where p in this Caſe is put for a *Pound Sterling)* a Part to the Whole, which is impoſſible.

I muſt confeſs, that the Multiplication of *Money* by *Money* is not applicable to any practical Uſes, but a mere Speculation, and ſerves only to exerciſe Youth in the Doctrine of *Fractions*. But if this ingenious Gentleman's Way of Reaſoning be allowed, then *Feet*, multiplied by *Feet*, muſt not produce *Feet*; and ſo a very uſeful Branch of the Mathematicks, *viz. Menſuration*, is founded upon an Abſurdity: For ſubſtituting f for a Foot, 4 f will be equal to 4 ff, after the ſame Manner as 4 p is equal to 4 pp. But to remove the Abſurdity: p is equal to 1 *Pound Sterling*;

Sterling; therefore 4 p is equal to 4 Times 1 *Pound*, that is, 4 *Pounds*.

Again, p is equal to 1 *Pound Sterling*; therefore pp is equal to but 1 *Pound*, and consequently 4 pp is equal to 4 *Pound*; so that 4 p is equal to 4 pp, without any Absurdity.

DIVISION *of* FRACTIONS.

RULE.

MUltiply the *Numerator* of the *Dividend*, by the *Denominator* of the *Divisor*, for the *Numerator* of the *Quotient*; then the *Denominator* of the *Dividend*, by the *Numerator* of the *Divisor*, for the *Denominator* of the *Quotient*.

1. Divide $\frac{12}{13}$ by $\frac{7}{8}$ *Fractionally* and *Decimally*.

96

$\frac{12}{13}$ $\frac{7}{8}$

91)96(1 $\frac{5}{91}$ Quotient.

5

Decimally.

$\frac{12}{13}$ | 12.000000000 (.923076923

Rem. 1

$\frac{7}{8}$ | 7.000 (.875

.875 | .923076923 (1.054945

18

$\frac{5}{91}$ | 5.000000 (.054945

Rem. 5

2. Di-

2. Divide $\frac{7}{8}$ of $\frac{8}{9}$ by $\frac{2}{3}$ of $\frac{3}{4}$ *Fractionally* and *Decimally.*

$$\frac{56}{72} \quad \frac{7}{8} \text{ of } \frac{8}{9} = \frac{7}{9} \qquad\qquad \frac{6}{12} \quad \frac{2}{3} \text{ of } \frac{3}{4} = \frac{1}{2}$$

$$\text{Divide } \frac{7}{9} \text{ by } \frac{1}{2} \quad (14)$$

$9)14(1\frac{5}{9}$ Quotient.

5

Decimally.

$7 \quad .777777$ | $1 \quad .5$
$9|7.000000$ | $2|1.0$
7

1.55555 | $5 \quad .555555$
$.5)777777$ | $9|5.000000$
2 | 5

3. Divide $7\frac{7}{8}$ by $3\frac{3}{4}$ *Fractionally* and *Decimally.*

$$\frac{252}{\begin{matrix} 63 & 15 \\ 7\frac{7}{8} & 3\frac{3}{4} \end{matrix}} \qquad \frac{12}{120} = \frac{1}{10}$$

$120)252(2\frac{1}{10}$

12

Decimally.

$7 \quad .875$ | $3 \quad .75$
$8|7.000$ | $4|3.00$

2.1

$3.75|7.875$

4. Divide $3\frac{3}{4}$ more $\frac{3}{80}$ by $2\frac{1}{2}$ more $\frac{1}{7}$ of $\frac{11}{21}$ *Fractionally* and *Decimally.*

$$\frac{252}{\dfrac{240 \quad 12}{\frac{3}{4} \text{ add } \frac{3}{80} = \frac{63}{80}}} \qquad \frac{11}{\dfrac{\frac{1}{7} \text{ of } \frac{11}{21}}{147}}$$

$$\begin{array}{c} 320 \\ 169 \\ \hline 147 \quad 22 \\ \hline \frac{1}{2} \text{ add } \frac{11}{147}, \\ \hline 294 \end{array} \quad \begin{array}{c} 89082 \\ \hline 303 \quad 757 \\ \hline \text{Divide } 3\frac{63}{80} \text{ by } 2\frac{169}{294} \\ \hline 60560|89082|1\frac{14261}{30280} \\ \hline 28522 \end{array}$$

$$\frac{28522}{60560} = \frac{14261}{30280}$$

Decimally.

$$\begin{array}{r} 3 \quad .75 \\ \hline 4|3.00 \end{array} \qquad \begin{array}{r} 3 \quad .0375 \\ \hline 80|3.0000 \end{array} \qquad \begin{array}{r} 1 \quad .5 \\ \hline 2|1.0 \end{array}$$

$$\begin{array}{r} 11 \quad .0748299 \\ \hline 147|11.0000000 \end{array} \qquad \begin{array}{r} .75 \\ \hline .0375 \\ \hline .7875 \end{array}$$

$$\begin{array}{r} .0748299 \\ .5 \\ \hline .5748299 \end{array}$$

$$\begin{array}{r} 1.4709 \\ \hline 2.5748299|3.78750000000 \\ \hline 19270109 \end{array}$$

5. Di-

5. Divide 19*s.* 7*d.* $\frac{1}{4}$ by 7*s.* 11*d.* $\frac{3}{4}$ *Fractionally* and *Decimally*.

Note: Before the Operation of this Example, it ought first to be determined whether a *Pound* or *Shilling* ought to be the *Integer*. But for the Learners Benefit I have inserted both Operations.

1. If a *Shilling* be *Integer*.

Then 7*d.* $\frac{1}{4}$ is 29 *Farthings*, which is $\frac{29}{48}$ of a *Shilling*.

And 11 $\frac{3}{4}$ is 47 *Farth.* that is $\frac{47}{48}$ of a *Shil.*

$$\frac{45168}{941 \quad 383}$$

Divide $19\frac{29}{48}$ by $7\frac{47}{48}$

```
18384)45168(2s.
      8400
        12
18384)100800(5d.
        8880
           4
18384)35520(1 257/383 f.
      17136
```

$\frac{17136}{18384} = \frac{257}{383}$

Decimally.

$\frac{29}{48}$ 48)29.000000(.604166 — 32

$\frac{47}{48}$ 48)47.000000(.979166 — 32

```
7.979166)19.6041666666(2.45691 Shill.
                          12
                        5.48292 d.
                           4
                        1.95168 f.
```

2. If a *Pound* be *Integer*.

Then 19 *s.* 7 $\frac{3}{4}$ *d.* is 941 *Farthings*, that is $\frac{941}{960}$ of a *Pound*.

And 7 *s.* 11 $\frac{3}{4}$ *d.* is 383 *Farthings*, that is $\frac{383}{960}$ of a *Pound*.

$$\overline{903360}$$

Divide $\frac{941}{960}$ by $\frac{383}{960}$

$$\underline{367680}$$

367680)903360(2 *l.*

168000

20

367680)3360000(9 *s.*

50880

12

367680)610560(1 *d.*

242880

4

367680)971520(2 $\frac{246}{383}$ *f.*

236160

$\frac{236160}{367680} = \frac{246}{383}$

Decimally.

$\frac{941}{960}$ | 941.0000000 | .9802083, remainder 320

$\frac{383}{960}$ | 383.000000 | .398958, remainder 320

.398958).980208333333(2.456921 £.

	20
Sh.	9.138420
	12
P.	1.661040
	4
F.	2.644160

Note;

Note: In the *Fractional* Operations of this Example, the *Denominators* being equal, might have been cancelled, and the *Numerator* of the *Dividend*, divided by the *Numerator* of the *Divisor*, would have anſwered the Queſtion, as may be ſeen by the following Operations.

$$\text{Divide } \frac{941}{48} \text{ by } \frac{383}{48}\qquad \frac{941}{383}$$

$$\begin{array}{r@{}l}
383)\underline{941}&(2\,s.\\
175&\\
\underline{12}&\\
383)\underline{2100}&(5\,d.\\
185&\\
\underline{4}&\\
383)\underline{740}&(1\tfrac{357}{383}f.\\
357&
\end{array}$$

$$\text{Divide } \frac{941}{960} \text{ by } \frac{383}{960}\qquad \frac{941}{383}$$

$$\begin{array}{r@{}l}
383)\underline{941}&(2\,l.\\
175&\\
\underline{20}&\\
383)\underline{3500}&(9\,s.\\
53&\\
\underline{12}&\\
383)\underline{636}&(1\,d.\\
253&\\
\underline{4}&\\
383)\underline{1012}&(2\tfrac{246}{383}f.\\
246&
\end{array}$$

From hence you plainly ſee, that in Diviſion of *Fractions*, if the *Denominators* be equal, they may be

be cancelled, and the Operation thereby more compendiously performed, because the *Numerator* of the *Dividend*, becomes the *Numerator* of the *Quotient*; and the *Numerator* of the *Divisor*, becomes the *Denominator* of the *Quotient*.

6. Divide 17 *l.* $\frac{7}{9}$, and $\frac{3}{4}$ of $\frac{5}{9}$ of a *Penny*, by 10 *l.* $\frac{2}{3}$ and $\frac{1}{48}$ of a *Shilling*, both by *Vulgar* and *Decimal Fractions*.

$$\frac{3}{4} \text{ of } \frac{5}{9} \text{ of } \frac{1}{240} = \frac{15}{8640} = \frac{1}{576}$$

$$\frac{7}{9} \text{ add } \frac{1}{576} = \frac{4032 + 9}{5184} = \frac{4041}{5184} = \frac{449}{576}$$

$$\frac{1}{48} \text{ of } \frac{1}{20} = \frac{1}{960}$$

$$\frac{2}{3} \text{ add } \frac{1}{960} = \frac{1920 + 3}{2880} = \frac{1923}{2880} = \frac{641}{960}$$

$$\text{Divide } 17\tfrac{449}{576} \text{ by } 10\tfrac{641}{960} \qquad \frac{9831360}{10241 \quad 10241}$$

```
5898816)9831360(1 l.
        3932544
             20
5898816)78650880(13 s.
         1966272
              12
5898816)23595264(4 d.
```

Decimally.

$$\frac{7}{9}\Big|\frac{.777777}{7.000000} \qquad \frac{1}{576}\Big|\frac{.00173611}{7.00000000}$$

.00173611
.77777777
.77951388

$2\ \ .666666$
$3 | 2.000000$

$1\ \ .0010416$
$960 | 1.0000000$

.0010416
.6666666

£.
10.6677082) 17.7795138888 (1.66666
20
Sh. 13.33320
12
D. 3.99840
4
F. 3.99360

Note : In the *Fractional* Operation of this Example, the *Numerators* being equal, might have been cancelled, and the Operation thereby more compendiously performed, because the *Denominator* of the *Divisor* becomes the *Numerator* of the *Quotient*, and the *Denominator* of the *Dividend* becomes the *Denominator* of the *Quotient*, as followeth.

960

Divide $\frac{10241}{576}$ by $\frac{10241}{960}$

576) 960 (1 *l.*
384
20
576) 7680 (13 *s.*
192
12
576) 2304 (4 *d.*

7. Divide 27 *l.* $\frac{5}{8}$ and $\frac{1}{2}$ of a *Shilling*; by 3 *l.* $\frac{9}{13}$ and $\frac{3}{4}$ of a *Farthing*, both by *Vulgar* and *Decimal Fractions.*

208

1   200   8

$\frac{1}{2}$ of $\frac{1}{20}$ $\frac{5}{8}$ add $\frac{1}{40} = \frac{13}{20}$

40   320   11533

3   11520   13

$\frac{3}{4}$ of $\frac{1}{960} = \frac{1}{1280}$ $\frac{9}{13}$ add $\frac{1}{1280}$

3840   9201920   16640

553 . 61453

Divide 27 $\frac{13}{20}$ by 3 $\frac{11533}{16640}$

122906|0) 920192|0 (7 *l.*
59850
20
122906) 1197000 (9 *s.*
90846
12
122906) 1090152 (8 *d.*
106904
4
122906) 427616 (3 $\frac{4207}{8779}$ *f.*
58898

$\frac{58898}{122906} = \frac{4207}{8779}$

X 2   *Decimally.*

Decimally.

$\frac{5}{8}\big|\frac{.625}{5.000}$ $\quad$ $\frac{1}{40}\big|\frac{.025}{1.000}$ $\quad$ $\begin{array}{r}.625\\ .025\\ \hline .650\end{array}$

$\frac{9}{13}\big|\frac{.692307}{9.000000}$ $\quad$ $\frac{1}{1280}\big|\frac{.000781}{1.000000}$ $\quad$ $\begin{array}{r}.000781\\ .692307\\ \hline .693088\end{array}$

£.

$$\begin{array}{r}
3.693088\,)\,27.65000000000\,(\,7.48695\\
20\\ \hline
Sh.\ 9.73900\\
12\\ \hline
d.\ 8.86800\\
4\\ \hline
f.\ 3.47200
\end{array}$$

8. Divide 113*l.* 14*s.* 10*d.* by 22*l.* 19*s.* $7\frac{1}{2}$, *Fractionally* and *Decimally*.

14*s.* 10*d.* is 178 *d.* that is $\frac{178}{240}$ or $\frac{89}{120}$ of a £.
19*s.* $7\frac{1}{2}$*d.* is 942 *Farth.* that is $\frac{942}{960}$ or $\frac{471}{480}$ of a £.

$$\frac{6551520}{13649 \qquad 11031}$$

Divide $113\frac{89}{120}$ by $22\frac{471}{480}$

$$\begin{array}{r}
132372|0\,)\,655152|0\,(\,4l.\\
125664\\
20\\ \hline
132372\,)\,2513280\,(\,18s.\\
130584\\
12\\ \hline
132372\,)\,1567008\,(\,11d.\\
110916\\
4\\ \hline
132372\,)\,443664\,(\,3\frac{1293}{3677}\\ \hline
46548
\end{array}$$

$\frac{46548}{132372}=\frac{1293}{3677}$

Decimally.

$$\frac{89}{120}\Big|\frac{.741666}{89.000000} \qquad \frac{471}{480}\Big|\frac{.981250}{471.000000}$$

$$\begin{array}{r} \text{£.} \\ 22.98125)\,113.7416666666\,(4.94932 \\ 20 \\ \hline Sh.\ 18.98640 \\ 12 \\ \hline d.\ 11.83680 \\ 4 \\ \hline f.\ 3.34720 \end{array}$$

Note: From what has been done you may obſerve, That when a *greater* Fraction is divided by a *leſs*, the *Quotient* will be greater than the *Dividend*, as you may ſee in the firſt and ſecond Examples, and in the fifth, where a *Pound* is the *Integer*. Conſequently, If *Integers* be divided by a *Fraction*, the *Quotient* will alſo be greater than the *Dividend*. So likewiſe, if *Integers* or *Fractions* be multiplied by another *Fraction*, the Product will be leſs than the *Multiplicand*.

Thus have I gone through the whole Work of *Fractions*, and illuſtrated the ſame with variety of Examples wrought at large, and ſuch as have not been treated of in any Books of *Arithmetic* that I have had the Opportunity of peruſing. I ſhall now proceed to the *Golden Rule*, and therein apply the Work of *Decimals*; it being my chief Deſign in this Treatiſe to recommend the Knowledge of ſo uſeful and excellent an Invention, as that of *Decimal Arithmetic*. Although the chief Uſe and Excellency thereof, conſiſteth more in *Geometrical* Computations, than in the common and

and practical Parts of *Arithmetic*: Yet how very useful it is even in these, especially in the Computations of *Interest* and *Annuities* will appear as we go on.

The GOLDEN RULE.

SO called by reason of its Excellency and universal Use, hath always *Three* Numbers given to find a *Fourth*. The greatest Difficulty here, if any, will be the right stating the Question, or placing down the *three* given Numbers in their proper Order. To do which observe,

That always *two* of the *three* given Numbers are a *Supposition*, and limits the Proportion, and the other is a *Demand*, and moves the Question, and hath commonly before it some such like Words as these, *What will*, *How many*, *How long*, *How far*, *How much*, *&c.* and is the *third* Number in the Proportion. The *first* Number is that Number in the *Supposition*, which is of the same Kind or Species with the *Demand*. And the *other* Number in the *Supposition* is the second.

For Instance: If four *Pound* of Sugar cost 2 *s.* 6 *d.* what will seven *Hundred Weight* cost at the same Rate.

Here 4 *lb.* and 2 *s.* 6 *d.* is the *Supposition*, and 7 *Hundred Weight*, is the *Demand*, as appears by the Words *What will* before it. Therefore 4 *lb.* in the *Supposition* being of the same Kind and Species with 7 ⊕ the *Demand*, is the *first* Number in the Proportion, and 2 *s.* 6 *d.* is the *second*, and 7 ⊕ the *Demand* is the *third*, and must be placed thus:

If

	lb.	*s.* *d.*	⊕
If	4 - - - - - - -	2 : 6 - - - - - - - -	7

The next thing to be obſerved is,

That the *firſt* and *third* Numbers be reduced into the ſame Denomination, and the *ſecond* Number into the *loweſt* Name mentioned.

That is, 7 ⊕ muſt be reduced into *Pounds*, to make it of the ſame *Denomination* with the *firſt* Number; and 2 *s.* 6 *d.* muſt be reduced into *Pence*, the loweſt Name here mentioned; and then the Queſtion will appear thus.

	lb.	*s.* *d.*	⊕
If	4 - - - - - - -	2 : 6 - - - - - - - - - -	7
		12	4
		30 *Pence.*	28 *Qrs.*
			28
			224
			56
			784 *lb.*

The next Thing to be obſerved is, That the *firſt* and *third* Numbers are called *Extremes*; and in order to find the *fourth* Number, which muſt bear the ſame Proportion to the *third* Number, as the *ſecond* doth to the *firſt*. You are to conſider, whether the *third* Number requires *more* or *leſs* than the *ſecond* Number for the *fourth*.

If *more* be required, multiply the *ſecond* Number and *greater* Extreme together, and divide the Product by the *leſſer* Extreme.

But if *leſs* be required, multiply the *ſecond* Number and *leſſer* Extreme together, and divide the Product by the *greater* Extreme, the Quotient ſhews the *fourth* Number or *Anſwer* to the Queſtion in the ſame *Denomination* with your *ſecond* Number.

Note:

Note: When Numbers, be they *Money*, *Weight*, or *Measure*, are required to be reduced into lesser or the least Denomination, *Multiplication* performs the Work, by beginning at the greatest Denomination, and multiplying it with the Number of *Units* of the next lesser Denomination, that make one of that Denomination you are reducing, and so proceeding till you are arrived to that lesser or least Denomination required.

To reduce Numbers of lesser Denominations into greater, is only the Converse of the former, and is performed by *Division*. The Practice of which you will meet with in the following Questions, inserted at large for the Learner's Instruction.

1. If 4 *Pounds* of Sugar cost 2 *s.* 6 *d.* what will 7 *Hundred Weight* amount to?

```
      ℔      s.  d.     C
If    4  . . 2 : 6 : :  7
            12          4
            ——         ——
            30         28
                       28
                      ———
                      784 ℔
                       30
                   ———————
                   4|23520
                   ———————
                  12|5880 Pence.
                     ————
                  2|0|49|0 Sh.
                      ——
                  £. 24 : 10
```

In this Question it is easy to conceive, that *more* is required; therefore the *second* Number 30, and *third* Number 784, which is the *greater* Extreme, are multiplied together, and divided by the *first* Number 4, which is the *lesser* Extreme. The

Quotient

Quotient 5880 is the *fourth* Number, and being *Pence*, is reduced into *Pounds*, and gives 24 *l.* 10 *s.* for the Answer to the Question.

Decimally.

4 ℔ is $\frac{4}{112}$ or $\frac{1}{28}$ of an Hundred Weight.
2 *s.* 6 *d.* is 30 *Pence*; that is, $\frac{30}{240}$ or $\frac{1}{8}$ of a £.

$$28 \,|\, 1.000000 \;(.035714 \qquad\qquad 8 \,|\, 1.000 \;(.125$$

$$\begin{array}{lllll} & \text{C} & & \text{£.} & & \text{C} \\ \text{If} & .035714 & : & .125 & :: & 7 \\ & & & 7 & & \\ \hline & .035714 \,|\, .8750000 \,|\, 24.5\ \text{£.} & & & & \\ & & & 20 & & \\ \hline & & \textit{Sh.} & 10.0 & & \end{array}$$

2. If when Wheat is 6 *s.* 6 *d.* *per* Bushel the *Penny Loaf* weigheth 8 Ounces, how much must the *Penny Loaf* weigh when Wheat is 9 *s.* *per* Bushel?

$$\begin{array}{lllllll} & s. & & d. & & oz. & \\ \text{If} & 6 & : & 6 & : & 8 & :: 9 \\ & 12 & & & & & 12 \\ \hline & 78 & & & & & 108 \\ & 8 & & & & & \end{array}$$

$$\begin{array}{l} 108 \,|\, 624 \,|\, 5\ oz. \\ \quad\ \ 84 \\ \quad\ \ 16 \\ \hline \quad\ \ 504 \\ \quad\ \ 84 \\ \hline 108 \,|\, 1344 \,|\, 12\tfrac{4}{9} \\ \quad\ \ 48 \end{array}$$

Decimally.

$$\begin{array}{llllll} & \text{℔.} & & oz. & & \text{℔.} \\ \text{If} & 6.5 & : & 8 & :: & 9 \\ & & & 8 & & \\ \hline & 9 \,|\, 52.0000 & & & & \\ \hline oz. & 5.7777 & & & & \\ & 16 & & & & \\ \hline & 46662 & & & & \\ & 7777 & & & & \\ \hline dr. & 12.4432 & & & & \end{array}$$

 Note:

Note: The dearer the Wheat, the leſs muſt be the *Penny Loaf*; therefore, the *ſecond* Number and *leſſer* Extreme are multiplied together, and the *Product* divided by the *greater* Extreme.

3. If 17 ℔ of *Figs* coſt 5 *s.* 3 *d.* what will 15 *Frails* amount to, each *Frail* containing 47 ℔?

```
15 Frails.          ℔    s.  d.      ℔
 47              If 17 : 5 : 3 :: 705
----                     12          63
105                     ----       -----
60                      63 Pence.  2115
----                               4230
705 ℔                             ------
                               17)44415(2612 d.
                                  -----
     12|2612                         11
     -------                          4
       21|7 : 8                      ---
                                 17)44(2 10/17 f.
  £. 10 : 17 : 8 1/2                ---
                                     10
```

Decimally.

3 *d.* is $\frac{3}{12}$ or $\frac{1}{4}$ of a Shilling.

```
                                      1  .25
                                      4|1.00
   ℔.     Sh.      ℔.
If 17 :  5.25 :: 705
          705
------------------
17|3701.2500|217.7205 Sh.
                   12
               ---------
            d. 8.6460
                    4
               ---------
            f. 2.5840
```

It is plain, that 705 ℔ will require *more* than 5 *s.* 3 *d.* therefore the *ſecond* Number and *greater* Extreme are multiplied together, and the *Product* divided by the *leſſer* Extreme.

4. A

4. A yearly *Pension* being 37 *l.* 15 *s.* what is that a *Week?*

	Days		*£.*		*Sh.*		*Days.*
If	365	:	37	:	15	::	7

```
      20
     ---
     755 Sh.
       7
    ----
365)5285(14 Sh.
    ----
     175
      12
    ----
365)2100(5 d.
    ----
     275
       4
    ----
365)1100(3 1/73 f.
    ----
       5
```

$\frac{5}{365} = \frac{1}{73}$

Decimally.

15 *s.* is $\frac{15}{20}$ or $\frac{3}{4}$ of a Pound.

```
3   .75
4|3.00
```

	Days.		*£.*		*Days.*
If	365	:	37.75	::	7

```
                7              £.
365)264.250000(.723972
                    20
                ---------
           Sh. 14.479440
                    12
                ---------
            d.  5.753280
                     4
                ---------
            f.  3.013120
```

Less being required, the *second* Number and *lesser* Extreme are multiplied together, and the *Product* divided by the *greater* Extreme.

5. A

5. A *Vintner* bought 1 Tun of White Wine for 50 *l.* and a Tun of Canary for 80 *l.* 7 *s.* 6 *d.* and mingleth them together; I demand what *one Gallon* of this Mixture cost him?

```
 50 : 00 : 0         Tun.   £.    s.  d.   Gall.
 80 : 07 : 6      If 2  :  130 : 7 : 6 :: 1
-------------          4     20
130 : 07 : 6          --    ----
                       8    2607
                      63      12
                     ---    ----
              Gall.  504
                     504)31290(62 1/12 d.
                           12        --------
 12     1                          Sh. 5 : 2 1/12
--- = ---
504    12
```

Decimally.

7 *s.* 6 *d.* is 90 *d.* that is $\frac{90}{240}$ or $\frac{3}{8}$ of a Pound.

```
3 .375        Gall.     £.          Gall.
8|3.000    If 504  :  130.375  ::  1
                            1
                     -----------
               504)130.37500(.25868 £.
                                  20
                              -------
                              5.17360
                                   12
                              -------
                           d. 2.08320
```

I need add no more, because the *Reader* cannot but see that *less* is required in this Question.

6. If for 3 *s*, 6 *d.* I have One Hundred Weight carried 60 Miles, how far shall 29 ℔. be carried for the same Money, at the same Rate?

If

lb. *Miles.* lb.
If 112 : 60 : : 29
60

29)6720(231 *Miles.*
21
8
29)168(5 $\frac{23}{29}$ *f.*
23

Decimally.
29 .258928
112|29.000000

If 1 : 60 : : .258928
1 231.724
.258928|60.000000000
Miles 231.724
8
Furlongs 5.792

In this Queſtion *more* is required, becauſe a *leſs* Weight ought be carried *farther* for the ſame Money.

7. A *Mariner* enter'd on Board a Man of War, *July* 29, 1729, and was diſcharged from thence *December* 24, 1731; what came his Wages to, at 1 *l.* 3 *s.* 6 *d.* *per Month?*

	Days.
From *July* 29, 1729, to *July* 29, 1730, is - -	365
From *July* 29, 1730, to *July* 29, 1731, is - -	365
Remaining Days in *July* is - - - -	3
Days in *Auguſt* - - -	31
September - -	30
October - - - -	31
November - - -	30
To the Time of Diſcharge, *December* - - -	24
Total Days of Service - - - -	879

Days.—0–12–0

	Days.	*£.*	*s.*	*d.*	*Days.*
If	28 :	1 :	3 :	6 ::	879

```
          20                  282
          ——                  ———
          23        28)247878(8852 Pence.
          12                  ———
          ——                   22
Pence    282                    4
                               ——
12|8852                   28)88(3 1/7 f.
2|0)73(7 : 8
   36 : 17 : 8 3/4 the Mariner's Wages.
```

Decimally.

3 *s.* 6 *d.* is 42 *d.* that is $\frac{42}{240}$ or $\frac{7}{40}$ of a £.

```
  7   .175        Days.    £.         Days.
40|7.000       If 28  :  1.175  ::   879
                                 879
                        28)1032.8250(36.8896 £.
                                         20
                                   Sh. 17.7320
                                         12
                                    d. 8.7840
                                          4
                                    f. 3.1360
```

```
      Mon.  Days.   l.  s.  d.
28)879(31  :  11  at 1 : 3 : 6 per Month.
                            10
   11              ———————————
                   11  15   0
                            3
                   ———————————
                   35  05   0
          D.        1   3   6
          7 - - - - - - 5  10 1/2
          4 - - - - - - 3   4 1/4
                   ———————————
Mariner's Wages - - 36  17   8 3/4
```

Note:

Note: The Pay of *Mariners* belonging to any of his Majesty's Ships or Vessels, is always accounted *per Month*, of 4 *Weeks*, or 28 *Days*.

But the Pay of *Mariners* in Merchant-Ships differ, being reckoned sometimes by the Voyage, and sometimes by the *Month*; and their *Month* is always a *Kalendar Month*, which is *one Month* and a Day in a Year *less* than the other.

8. *A* borrowed of *B* 137 *l.* 10 *s.* which at the Year's End he paid with Thanks, and promised to do *B* the like Courtesy: Some Time after, *B* borrowed of *A* 322 *l.* 15 *s.* *How long* must he keep it to requite his former Courtesy to *A*?

	l.		*s.*		*Days.*		*l.*		*s.*
If	137	:	10	:	365	::	322	:	15
	20						20		
	2750						6445		
	365								

Days.

$6445)1003750(155\frac{645}{1289}$

3225

$$\frac{3225}{6445} = \frac{645}{1289}$$

Decimally.

	£.		*Days.*		*£.*
If	137.5	:	365	:	322.7
	365				

Days.

322.75)50187.500000(155.4996

It is plain, that *more* Money being lent, *less* Time is required to keep it.

9. If

9. If $\frac{3}{4}$ of $\frac{5}{9}$ of a Yard of Cloth cost $\frac{2}{3}$ of $\frac{7}{8}$ of a *Pound Sterling*, what will 791 Yards amount to?

$$\frac{15}{36} \qquad \frac{35}{54}$$

$$\frac{3}{4} \text{ of } \frac{5}{9} = \frac{5}{12} \qquad \frac{5}{6} \text{ of } \frac{7}{9}$$

$$\frac{27685}{54}$$

Yd.

$$\text{If } \frac{5}{12} : \frac{35}{54} :: \frac{791}{1}$$

$$\frac{333220}{}$$

$$\text{Divide } \frac{27685}{54} \text{ by } \frac{5}{12}$$

27|0)33322|0(1230 £.

12
20

27)240(8 *Sh.*

24
12

27)288(10 *d.*

18
4

27)72(2 $\frac{2}{3}$ *f.*

18

$\frac{18}{27} = \frac{2}{3}$

Decimally.

Decimally.

$\frac{5}{12}\Big|\frac{.4166}{5.0000}$ $\qquad$ $\frac{35}{54}\Big|\frac{.6481481}{35.0000000}$

Yds. $\quad$ £. $\quad$ *Yds.*

If .416666666 : .648148148148 1 : : 791

791 $\quad$ £.

.416666666) 512.685185185147 1 (1230.4444

1933877 67

	20
Sh.	8.8880
	12
d.	10.6560
	4
f.	2.6240

10. Bought 19 $\frac{5}{9}$ *Tun* of Wine, at 3 *s.* $\frac{3}{4}$ and $\frac{7}{8}$ of a *Penny*, *per* Quart. I demand how much I paid for the whole?

$$\frac{7}{8} \text{ of } \frac{1}{12} \left(\frac{7}{96}\right) \qquad \frac{7}{96} \text{ add } \frac{3}{4} = \frac{79}{96}$$

7 $\quad$ 96 $\qquad$ 28 $\quad$ 288 $\quad$ 316 $\quad$ 384

Hhds	4
	63
Gallons	252
	4
Quarts	1008

Tun. $\quad$ *Sh.* $\quad$ *Tun.*

$$\text{If } \frac{1}{1008} : 3\frac{79}{96} :: 19\frac{5}{9}$$

367 $\quad$ 176 $\quad$ 64592

$$\text{Mult. } 3\frac{79}{96} \text{ by } 19\frac{5}{9}$$

864

65108736

$$\text{Divide } \frac{64592}{864} \text{ by } \frac{1}{1008}$$

65108736

864) 65108736 (75357 *Shill.*
 736
 288
 12
864) 3456 (4 *Pence.*

Decimally.

$\frac{1}{1008}$ | 1.000000000000 (.000992063492

$\frac{7}{96}$ | 7.00000000 (.07291666

$\frac{3}{4}$ | 3.00 (.75

.07291666
.75
.82291666

$\frac{5}{9}$ | 5.0000 (.5555

Tun.		*Shillings.*		*Tun.*
If .000992063492	:	3.8229166666	: :	19.555555

3.8229166666
19.555555

.000992063462) 74.759257134I129630 (75357.3311 *Shillings.*
 12
d. 3.9732
f. 3.8928

In the following Examples, wherein Allowance is made for *Tare* and *Tret*, obſerve,

That *Groſs* is the whole Weight of any Commodity, together with the *Hogſhead*, *Cheſt*, or *Box*, or whatſoever elſe contains it.

Tare is the Weight of the *Hogſhead*, *Cheſt*, or *Box*, *&c.* and is ſometimes rated at a certain Number of *Pounds per Hundred Weight*.

Trett is an Allowance of 4 *lb.* in every 104 *lb.* for Waſte and Duſt on ſome Sort of Goods; ſuch as *Tobacco*, *Indigo*, and all *Spices*.

Neat

Neat is the Weight of a Commodity, after the *Tare* and *Trett* is deducted.

C. Q. *lb.*

11. What will 362 3 16 *Gross* amount to, at 3*l.* 11*s.* 4*d.* *per* C *Neat.* *Tare* 18*lb.* *per* C.

lb. *lb.* C Q. *lb.*

If 112 : 18 :: 362 : 3 : 16

4

1451 *qrs.*

28

40644 *lb.*

18

lb.

112)731592(6532 *Tare.*

8

lb.

From 40644 *Gross.*

Take 6532 *Tare.*

Rem. 34112 *Neat.*

C *l.* *s.* *d.* *lb.*

If 112 : 3 11 4 :: 34112

20 856

71 112)29199872(260713 $\frac{1}{7}$ *Pence.*

12 16

856

12)260713

2|0)2172|6 : 1

£. 1086 : 6 : 1 $\frac{1}{7}$

Decimally.

18 *lb.* is $\frac{18}{112}$ or $\frac{9}{56}$ of an C. $\frac{9}{56}$|9.000000(.160714

qrs. *lb.*

3 : 16 is 100 that is $\frac{100}{112}$ or $\frac{25}{28}$ of an C.

$\frac{25}{28}$|25.000000(.892857

If 1 : .160714 : : 362.892857
.160714

Tare 58.3219626198982

From 362.892857 *Gross.*
Take 58.321962 *Tare.*

Rem. 304.570895 *Neat.*

11*s.* 4*d.* is 136 *Pence*, that is $\frac{136}{240}$ or $\frac{17}{30}$ of a £.

$\frac{17}{30}$ | 17.0000 | .5666

£.
If 1 : 3.566666 : : 304.570895
3.566666

£. 1086.3026557860705
20

Shil. 6.053115721400
12

Pence .637388656800
4

Far. 2.549554627200

Note : The *Decimal* Operation gathers up the *Fractions* in the *Tare*, which is omitted in the *Vulgar* Operation, and from hence it is, that the *Vulgar* exceeds the *Decimal* by 2 *Farthings.*

12. At

12. At 7 *d.* ½ *per* ℔. what will 9 *Hhds.* of *Sugar* amount to, each *Hhd.* weighing 4 C. 2 Q. 17 ℔. *Tare* 47 ℔. ¼ *per Hhd.*

C.	Q.	℔		℔
4 :	2 :	17		47 ¼
4				4
18				189
28				9
521				1701 *Qrs. lb. Tare.*
9				
4689 *lb. Gross.*				
4				

From 18756 *Qrs. lb. Gross.*
Take 1701 *Qrs. lb. Tare.*
Rem. 17055 *Qrs. lb. Neat.*

	Qrs. lb.	*d.*		*Qrs. lb.*
If	4 :	7 ½	: :	17055
		4		30
		30		4|511650

Farth. 127912 = ½

4|127912

12|31978

2|0)266(4 : 10

£. 133 : 4 10 : 0 ½

Decimally.

Decimally.

521 lb the Weight of 1 *Hhd.*

$\underline{\quad 9}$

From 4689 *Gross.*
Take $\underline{425.25}$ *Tare.*

Rem. 4263.75 *Neat.*

lb
47.25 *Tare of* 1 *Hhd.*
$\underline{\quad 9}$
425.25

lb *Pence.* lb
If 1 : 7.5 : 4263.75
$\underline{7.5}$

Pence 31978.125

12|31978
20) 266 (4 : 10
£. 133 : 4 : 10

13. At 6 *s.* 10 *d. per* lb. what cost 6 Barrels of *Nutmegs*, each Barrel weighing 3 C. 2 Q. 21 lb. *Tare* 37 ¼ lb. *per* Barrel, *Trett* 4 lb. *per* 104?

Where Allowance is made for *Trett*, when the *Tare* is subtracted from the *Gross*, the *Remainder* is called *Subtle*, (not *Neat*, as aforegoing) which divided by 26, gives the whole Allowance for *Trett*, because 26 lb. is ¼ Part of 104; this subtracted from the *Subtle*, leaves the *Neat* Weight.

C Q lb
3 : 2 : 21
$\underline{4}$
14
$\underline{28}$
413
$\underline{4}$
1652 *Qrs. lb. in* 1 *Barrel.*
$\underline{6}$
9912 *Qrs. lb. Gross.*

lb
37 ¼
$\underline{4}$
149
$\underline{6}$
894 *Qrs. lb. Tare.*

Qrs. lb.

```
          Qrs. lb.
From      9912  Gross
 Take      894  Tare.          26)9018(346 22/26
Rem.      9018  Subtle.               22
 Take      346  Trett.
          8672  Neat.

Qrs. lb.  s.   d.      Qrs. lb.
If  4  :  6 : 10  ::   8672
         12              82
         82          4|711104
                   12|177776  Pence.
                   2|0)1481(4 : 8
                   £. 740 : 14 : 8
```

Decimally.

```
 413 lb in a Barrel ;  37.25 Tare of a Barrel.
   6                       6
2478 Gross.           223.50 whole Tare.
 223.50 Tare                 86.711538
2254.50 Subtle,        26|2254.500000
  86.711538 Trett,
2167.788462 Neat.
```

6 *s.* 10 *d.* is 82 *Pence*; that is, $\frac{82}{240}$ or $\frac{41}{120}$ of a £.

```
      41      .341666
   120|41.000000

    lb       £.              lb
If  1  :  .341666  ::  2167.788462
                          .341666
               £. 740.659612657692
                               120
               Sh. 13.192253153840
                                12
                d. 2.307037846080
                                 4
                f. 1.228151384320
```

The Difference between *this* Operation and the *Vulgar*, proceeds from the *Fraction* in the *Trett*, which this takes in, though the other omits it.

14. Two Merchants, *A* and *B*, *barter*. *A* hath 13 *Tun*, 2 *Hbds*. of *Wine*, worth 50 *l*. *per Tun*. *B* hath *Sugar* worth 6 *d*. *per lb*. I demand how much *Sugar B* must give *A* for his *Wine*?

Tun.	*£.*	*Tun.*	*Hbds.*	*d.*	*lb.*	*£.*
If 1 :	50 :	13 :	2	If 6 :	1 : :	675
4		4				20
4		54				13500
		50				12
		4|2700				6|162000
						27000 *l*.

Price of *A*'s Wine 675 £.

28)27000(964
8
241 : 0 : 8 of *Sugar*, which *B* must
C. Q. lb
give *A* for his *Wine*.

Decimally.

Tun. *£.* *Tun.*
If 1 : 50 : : 13.5 — 6 *d*. is $\frac{6}{240}$ or $\frac{1}{40}$ of a £.

50 — 1 .025
675.0 — 40\|1.000

1 *lb*. is $\frac{1}{112}$ of an C. — 1 .00892857
112\|1.00000000

£. C.
If .025 : .00892857 : : 675
675
.025)6.02678475(241.07139 C.
28
lb. 7.99568
4
Qrs. 3.98272

15. Two

15. Two Men, *A* and *B*, *barter*. *A* hath 357 Ream of *Paper*, worth 9 *s.* 7 *d.* *per* Ream; for which *B* giveth 74 *l.* 11 *s.* 6 *d.* *ready Money*, and the rest he must, by Agreement, give in *Broad Cloth*, at 21 *s.* 9 *d.* *per* Yard. I demand how much *Broad Cloth* will satisfy?

R.	s.	d.		R.
If 1 :	9 :	7	::	357
	12			115
	115			12|41055
				2|0)342(1 : 3
				£. 171 : 1 : 3

	l.	s.	d.	
From	171 :	1 :	3	Pr. of Pap.
Take	74 :	11 :	6	Paid.
Rem.	96 :	9 :	9	to be returned in Broad Cloth.

l.	s.	d.	Yd.		l.	s.	d.
If 1 :	1 :	9 :	1	::	96 :	9 :	9
20					20		
21					1929		
12					12		
261							

261)23157(88 $\frac{21}{29}$ Yards of Broad Cloth that will satisfy.
89

$\frac{89}{261} = \frac{21}{29}$

Decimally.

9 *s.* 7 *d.* is 115 *d.* that is, $\frac{115}{240}$ or $\frac{23}{48}$ of a £.

23 .479166
48|23.000 00

	R.		£.		R.
If	1	:	.479166	::	357
			357		
		£.	171.062262		

11 *s.* 6 *d.* is 138 *d.* that is, $\frac{138}{240}$ or $\frac{23}{40}$ of a £.

23 .575
40|23.000

From 171.062262 £. Price of Paper.
Take 74.575 - - - Money paid.
£. 96.487262 to be return'd in Cl.

1 *s.* 9 *d.* is 21 *d.* that is, $\frac{21}{240}$ or $\frac{7}{80}$ of a £.

7 .0875
80|7.0000

	£.		*Yd.*		£.
If	1.0875	:	1	::	96.487262
					1 *Yds.*

1.0875)96.487262(88.72

16. Two Men, *A* and *B*, *barter*. *A* hath *Nutmegs*, which cost him 7 *s.* 8 *d. per* ℔; but in *Barter* will have 9 *s.* 6 *d. per* ℔. *B* hath *Cinnamon*, which cost him 8 *s.* 8 *d. per* ℔. I demand how he must rate his *Cinnamon*, to make his Gain in *Barter* equal to that of *A*?

$$
\begin{array}{llllllllllll}
 & s. & & d. & & s. & & d. & & s. & & d. \\
\text{If} & 7 & : & 8 & : & 9 & : & 6 & :: & 8 & : & 8 \\
 & 12 & & & & 12 & & & & 12 & & \\
\hline
 & 92 & & & & 114 & & & & 104 & &
\end{array}
$$

$$
\begin{array}{r}
114 \\
104 \\
\hline
92)11856(128 \\
\hline
80 \\
4 \\
\hline
92)320(3\frac{11}{23} \\
\hline
44
\end{array}
\qquad \frac{44}{92} = \frac{11}{23}
$$

Decimally.

8 *d.* is $\frac{8}{12}$ or $\frac{2}{3}$ of a Shilling. $\quad 3|2.000000 = .666666$

6 *d.* is $\frac{6}{12}$ or $\frac{1}{2}$ of a Shilling. $\quad 2|1.0 = .5$

$$
\begin{array}{lllll}
 & s. & & s. & s. \\
\text{If} & 7.666 & : & 9.5 & ::\ 8.666666 \\
 & & & & 9.5 \\
\hline
\end{array}
$$

$$
\begin{array}{r}
7.666)82.3333270(10.74\ Sh. \\
12 \\
\hline
d.\ 8.88 \\
4 \\
\hline
f.\ 3.52
\end{array}
$$

17. Two Merchants, *A* and *B*, *barter*. *A* had 13 C. 3 Q. 10 ℔. of *Sugar*, worth 6 *d.* $\frac{1}{2}$ *per* ℔; for which

which *B* gave him 27 C. 2 Q. 20 ℔. of *Figs*. I demand how *B* rated his *Figs*?

```
 ℔  d.      C.  Q. ℔
If 1 : 6½ :: 13 : 3  10     C.   Q.   ℔    Farth.   ℔
     4        4          If 27 : 2 : 20 : 40300 :: 1
    --      --               4                1
    26      55              --             ------
            28             110      3100)40300(13 f.
          ----              28                ---
          1550             ---               d. 3¼
            26            3100       Rate of B's Figs.
          ----
Farth.   40300 whole
 Worth of A's Sugar.
```

Decimally.

```
 lb.  d.      lb.      lb.      d.       lb.
If 1 : 6.5 :: 1550   If 3100 : 10075 :: 1
                6.5                1
           --------          ---------
Pence      10075.0      3100)10075.00(3.25 d.
                                        4
                                     ----
                                  F. 1.00
```

18. A *Merchant* bought 13 C. 3 Q. 21 *lb.* of *Sugar*, at 5 *d.* ¼ *per lb.* and selleth it again for 6 *d.* ½ *per lb.* I demand how much he *gained* by the Whole?

```
      d.              lb.  d.      C.   Q.  lb.
From 6½             If 1 : 1¼ :: 13 : 3 ; 21
Take 5¼                    4        4
     --                   --      ---
Rem. 1¼                    5       55
                                   28
                                 ----
 Decimally.                      1561
                                    5
      d.                         ----
From 6.5                       4|7805
Take 5.25                      ------
     ----                   |12|1951 ¼
Rem. 1.25                    ------
                            2|0)16(2 : 7
                             £. 8 : 2 : 7¼
```

	lb.		*d.*		*lb.*
If	1	:	1.25	::	1561
					1.25

12|1951   *d.* 1951.25

2|0)16(2 : 7   4

£. 8 : 2 : 7¼   *f.* 1.00

19. A *Draper* bought 2569 Yards of *Holland* for 510 *l.* 17 *s.* 8 *d.* being damnified; he is willing, in the Sale thereof, to *lose* 8 *per Cent.* I demand how he must sell it *per* Yard.

	l.
From	100
Take	8
Rem.	92

	l.		*l.*		*l.*		*s.*		*d.*
If	100	:	92	::	510	:	17	:	8
	20				20				
	2000				10217				
	12				12				
	24000				122612				
					92				

24000)11280304(470 £.

304
20

6080
12

24000)72960(3 $\frac{1}{25}$ *d.*

960

	l.		*s.*		*d.*
Again :	510	:	17	:	8
					8
£.	40|87	:	01	:	4
	20				
Sh.	17|41				
	12				
d.	4|96				
f.	3.84				

	l.		*s.*		*d.*
From	510	:	17	:	8
Take	40	:	17	:	4¾
£.	470	:	00	:	3¼

If

```
     Yds.     l.    s.   d.     Yd.
If 2569 : 470 : 00 : 3 :: 1
                20
              ----
              9400
                12
            ------  d.    s.   d.
   2569)112800(43 is 3 : 7 1/4 per Yard.
             -----
              2336
                 4
             -----
   2569)9344(3 1637/2569 f.
             -----
              1637
```

Decimally.

17*s.* 8*d.* is 212*d.* that is, $\frac{212}{240}$ or $\frac{53}{60}$ of a £.

```
       53   .883333
      60|53.000000

     £.      £.       £.
If 100 : 92 : 510.83333
                       92
              -----------
        100)47001.266636(470.01266 £.
                                      20
                                  ------
   Yds.        £.          Yd.   .253320
If 2569 : 470.012666 :: 1             12
                     1            ------
              --------        d. 3.039840
   2569)470.012666(.182955 £.
                             20
                      --------
                 Sh. 3.659100
                             12
                      --------
                  d. 7.909200
                              4
                      --------
                  f. 3.636800
```

20. A Merchant in *Flanders* delivers 500 *l. Flemish*, to receive the fame again at *London*; the Exchange at 35 *s.* 6 *d. Flemish per Pound Sterling*: How much muft he receive?

	s.	*d. Flem.*	*l. Eng.*	*l. Flem.*
If	35 :	6 . .	1 : :	500
	12			20
	426			10000
				12

426)120000(281 £.
Rem. 294
20
426)5880(13 *Sh.*
342
12
426)4104(9 *d.*
270
4
426)1080(2 *f.*
228

Decimally.

15 *s.* 6 *d. Flemish* is $\frac{186}{240}$ or $\frac{31}{40}$ of a £. *Flemish.*

31 ·775
40|31.000

	£. *Flem.*	£. *Ster.*	£. *Flem.*
If	1.775 . .	1 : :	500

1.775)500.00000(281.69 £. *Sterl.*
Rem. 25 20
Sh. 13.80
12
d. 9.60
4
f. 2.40

21. A

21. A Merchant at *London* delivered 2220 *l.* to receive the same at *Paris*, at $3\frac{1}{3}$ *French Crowns per Pound Sterling*, What must he receive?

$$
\begin{array}{llcll}
 & \text{£.} & & \textit{Fr. Crowns.} & \\
\text{If} & 1 & \text{- - - -} & 3\tfrac{1}{3} & :: \ 2220 \\
 & & & 3 & \qquad 10 \\
\hline
 & & & 10 & 3|22200 \\
\hline
 & & & & \quad 7400 \ \textit{Crowns.}
\end{array}
$$

Decimally.

$$
\begin{array}{llcll}
\text{If} & 1 & \text{- - - -} & 3.3333 & :: \ 2220 \\
 & & & 2220 & \\
\hline
 & & & 7399.9260 & \textit{French Crowns.}
\end{array}
$$

22. A Merchant at *Cadiz* receiveth 1500 *Ducats*, to pay the same again by his Correspondent at *London*; the Exchange $58\frac{1}{2}$ *Pence per Ducat*; How much doth it amount to?

$$
\begin{array}{llcll}
 & \textit{Ducat.} & & \textit{Pence.} & \textit{Ducats.} \\
\text{If} & 1 & \text{- - - -} & 58\tfrac{1}{2} & :: \ 1500 \\
 & & & 4 & \\
\hline
 & & & 234 & \\
 & & & 1500 & \\
\hline
 & & & 4|351000 & \textit{Farth.} \\
\hline
 & & & 12|87750 & \\
\hline
 & & & 20|731|2 : 6 & \\
\hline
 & & & \text{£. } 365 : 12 : 6 &
\end{array}
$$

Decimally.

$58\frac{1}{2}$ *d.* is 234 *Farthings*, that is $\frac{234}{960}$ or $\frac{39}{160}$ of a £.

$$
\frac{39}{160} \quad 160|39.00000 \ (.24375
$$

If

	Ducat.		*£.*		*Ducats.*
If	1	- - -	.24375	: :	1500

1500

£. 365.62500
20

Sh. 12.50000
12

d. 6.00000

23. A Merchant at *London* receiveth from his Correſpondent abroad, his Account Currant, the Ballance of which is 756 *Dollars*, the Exchange at 53 $\frac{7}{8}$ *Pence per Dollar* : What doth it amount to?

	Dollar.		*Pence.*		*Dollars.*
If	1	- - - -	53 $\frac{7}{8}$	: :	756

8

431
756

8|325836

12|40729 : $\frac{1}{2}$

20|339|4 : 1

£. 169 : 14 : 1 $\frac{1}{2}$.

Decimally.

	Dollar.		*Pence.*		*Dollars.*
If	1	- - - -	53.875	: :	756

756

12|40729.500 *Pence.*

20|339|4 : 1

£. 169 : 4 : 1 $\frac{1}{2}$.

24. A Carrier received 50 *Shillings* for the Carriage of 3 ⊕. 3 *qrs.* 21 *lb.* 137 *Miles*; I demand how much he ought to receive at that Rate, for the carrying of 2 ⊕. 1 *qr.* 21 *lb.* 279 Mile.

First, I find what he ought to receive for the Carriage of 3 ⊕. 3 *qrs.* 21 *lb.* 279 *Mile.*

```
       M.          Sh.     M.
    If 137 - - - - 50 :: 279
                          50
                        -----
                :: 137)13950(101 Shil.
                       -----
                         113
                          12
                       -----
                   137)1356(9 d.
                       -----
                         123
                           4
                       -----
                   137)492(3 81/137 f.
```

```
   ⊕. qrs. lb.            s.   d.          ⊕. qrs, lb.
If 3   3   21 - - - -   101   9 3/4  ::    2   1   17
   4                     12                4
  ---                  ----               ---
   15                  1221                9
   28                     4               28
  ----                 ----              ----
  441 lb.              4887 Far.          269 lb.
                        269
                  ---------     Far.
            441 ) 1314603 ( 2980 423/441 = 47/49
                  -------   ----
                      423 12)745
                             ---
                          20)6|2 : 1
                             ---
                 Answer £. 3 : 2 : 1
```

 Decimally.

Decimally.

	M.		*£.*		
If	137	- - -	2.5	: :	279

2.5

137)697.50000(5.09124 *£.*

12

qrs. lb. *lb.*

3 21 is 105, that is $\frac{105}{112}$ of an ⊕. $\frac{105}{112}$ | 105.0000 (.9375

1 17 is 45, that is $\frac{45}{112}$ of an ⊕. $\frac{45}{112}$ | 45.000000 (.401785

	⊕.		*£.*		⊕.
If	3.9375	. .	5.09124	: :	2.401785

5.09124

3.9375)12.22806386340(3.10554 *£.*

113

20

Shill. 2.11080

12

d. 1.32960

25. If 40 Acres of Graſs can be mowed by 9 *Men* in 7 *Days*, How many Acres may be mowed by 24 *Men* in 28 *Days ?*

Firſt, I find how many Acres can be mowed by 24 *Men* in 7 *Days.*

	Men.		*Acres.*		*Men.*
If	9	. . . .	40	: :	24

40

9)960(106 *Acres.*

6

4

9)24(2 *Rood.*

6

40 *Pole.*

9)240(26$\frac{6}{9}$=$\frac{2}{3}$

6

If

Days.	*Acres.*	*R.*	*P.*		*Days.*
If 7 - - -	106	2	26	: :	28

```
        4
       426            40|68264
        40             4|1706 : 24
     17066 Poles.  Acres 426 : 2 : 24
        28
  7)477848(68264 Poles.
```

Decimally.

Men.	*Acres.*		*Men.*
If 9 . .	40	: :	24

```
                  40              Acres.
              9)960.00000( 106.66666
                        6
```

Days.	*Acres.*		*Days.*
If 7 . .	106.66666	: :	28

```
                    28        Acres.
         7)2986.66648(426.66664
                              4
                 Rood  2.66656
                             40
                 Pole 26.66240
```

26. If 48 *Pioneers* in 12 *Days*, can cast a Trench 24 *Yards* long: In how many Days will 162 *Pioneers* cast a Trench 108 *Yards*.

First, I find in how many Days 162 *Pioneers* will cast a Trench 24 Yards long.

```
   Pio. da.   pio.   Yds. da. ho. min.   yds.
   If 48 . 12 :: 162.  If 24 . 3 : 13 : 20 :: 108.
        12                    24
 162)576(3 days.              85
      90                      60
      24                    5120 min.
 162)2160 13 hours.          108
      54               24)552960(23040 min.
      60                      24)384
 162)3240(20 min.           Answer 16 days.
```

Decimally.

	Pio.		*Days.*		*Pio.*
If	48	. .	12	: :	162
	12				

162)576.000000(3.555555 *Days.*

	Yds.		*Days.*		*Yds.*
If	24	. .	3.555555	: :	108
			108		

24)383999940(15.999997 *Days.*

12

27. Four Merchants, *A*, *B*, *C*, and *D*, make a Stock. *A* put in 227 *l.* *B* 349 *l.* *C* 115 *l.* and *D* 439 *l.* In trading they gained 428 *l.* I demand each Merchant's Share of the Gain?

All Queſtions of this Kind are anſwered by ſo many ſeveral Operations in the *Rule of Three*, as there are *Partners* in the Stock.

RULE.

As the total Stock, is to the Gain or Loſs, ſo is each Man's Stock, to his Share of the Gain or Loſs.

	£.
A's Stock - - - - - -	227
B's - - - - - - - - -	349
C's - - - - - - - - -	115
D's - - - - - - - - -	439
Total - - - -	1130

If

£. £. £.
If 1130 . . 428 : : 349
349
1130)149372(132 £.
212
20
113|0)424|0(3 *Sh.*
85
12
113)1020(9 *d.*
3
4
113)12(0 $\frac{12}{113}$ *f.*

£. £. £.
If 1130 . . 428 : : 227
227
1130)97156(85 £.
1106
20
113|0)2212|0(19 *sh.*
65
12
113)780(6 *d.*
102
4
113)408(3 $\frac{69}{113}$ *f.*
69

£. £. £.
If 1130 . . 428 : : 115
115
113|0)4922|0(43 £.
63
20
113)1260(11 *Sh.*
17
12
113)204(1 *d.*
91
4
113(364(3 $\frac{25}{113}$ *f.*
25

£. £. £.
If 1130 . . 428 : : 439
439
1130)187892(166 £.
312
20
113|0)624|0(5 *Sh.*
59
12
113)708(6 *d.*
30
4
113)120(1 $\frac{7}{113}$ *f.*
7

	l.	s.	d.	
A's Part of the Gain	85	19	6 ¼ - -	69
B's - - - - - -	132	3	9 - -	12
C's - - - - - -	43	11	1 ¼ - -	25
D's - - - - - -	166	5	6 ¼ - -	7
Proof - - £.	427	19	11 ¼	113

Decimally.

If the *Gain* be divided by the Sum of all the Stocks, the *Quotient* becomes a *Multiplier*, or *Multiplicand*, to each Man's Stock, and will determine the Gain.

1130)428.000000(.378761

70

.378761	.378761
C's Stock 115	*A*'s Stock 227
£. 43.557515	£. 85.978747
20	20
Sh. 11.150300	*Sh.* 19.574940
12	12
d. 1.803600	*d.* 6.899280
4	4
f. 3.214400	*f.* 3.597120
.378761	.378761
B's Stock 349	*D*'s Stock 439
£. 132.187589	£. 166.276079
20	20
Sh. 3.751780	*Sh.* 5.521580
12	12
d. 9.021360	*d.* 6.258960
	4
	f. 1.035840

28. Two Men, *A* and *B*, join their Stocks. *A* had 344 *l.* 15 *s.* 9 *d.* *B* 213 *l.* 5 *s.* They gained in trading 578 *l.* 14 *s.* 9 *d.* I demand each Man's Share of the Gain?

	l.	*s.*	*d.*
The Stock of *A* - - -	344	15	9
The Stock of *B* - - -	213	5	0
Total - - -	558	0	9

```
     l.   s.  d.       l.   s.  d.       l.   s.  d.
If  558 : 0 : 9 ..   578 : 14 : 9  ::  344 : 15 : 9
     20                20                20
  ------             ------            ------
  11160             11574              6895
     12                12                12
  ------             ------            ------
 133929 d.          138897 d.         82749 d.
                     82749
        ----------------------
 133929)11493587853(85818 d.
                  ------
                   68931
                       4              12|85818
                ---------                 ------
      133929)275724(2 f.            2|0)715(1 : 6
             ------
               7866                £. 357 : 11 : 6½

    Pence.        Pence.          l.    s.
If  133929  ..   138897   ::    213 :: 05
                  51180          20
            --------------      ----
133929)7108748460(53078          4265
             ----------            12
              64998             ------
                  4              51180 d.
            ---------
    133929)259992(1           12|53078
           ---------              ------
             126063         2|0)442(3 : 2
                                ----
                                221 : 3 : 2¼
```

Decimally.

Decimally.

s. *d.*
15 : 9 is 189 *d.* that is, $\frac{189}{240}$ or $\frac{63}{80}$ of a £.
5 : 0 is $\frac{5}{20}$ or $\frac{1}{4}$ of a £.
14 : 9 is 177 *d.* that is, $\frac{177}{240}$ or $\frac{59}{80}$ of a £.

63 .7875	1 .25	59 .7375
80)63.0000	4)1.00	80)59.0000

A's Stock	344.7875		
B's - - -	213.25		1.037094
Total	558.0375	578.7375000000	
		1569750	

	344.7875		1.037094
	1.037094		213.25
£.	357.5770475250	£.	221.16029550
	20		20
Sh.	11.5409505000	*Sh.*	3.20591000
	12		12
d.	6.4914060000	*d.*	2.47092000
	4		4
f.	1.9656240000	*f.*	1.88368000

29. Three Merchants accompany. *A* had in Stock 230 *l.* 7 *Months*; *B* 290 *l.* 10 *Months*; and *C* 326 *l.* 4 *Months*. They gained together 219 *l.* 10 *s.* What was each Man's Share of the Gain?

Note: When *Time* is annexed to the *Stock*, then each Man's *Stock* must be multiplied by its *Time*, and proceed as afore.

A's

A's Stock - - 230 £. 7 Months.
7
1610

B's Stock - - 290 £. 10 Months.
10
2900

C's Stock - - 326 £. 4 Months.
4
1304

1610
2900
1304
Total 5814

l. *s.*
If 5814 . . 219 : 10 : : 1610
20
Sh. 4390
1610
5814)7067900(121|5 *Sh.*
3890 £. 60 : 15 : 8 *A*'s Share.
12
5814)46680(8 *d.*
168
4
672

s.
If 5814 . . 4390 : : 2900
2900
5814)12731000(218|9 *Sh.*
4154 £. 109 : 9 8 ½ *B*'s Share.
12
5814)49848(8 *d.*
3336
4
5814)13344(2 *f.*
1716

Sh.

If 5814 . . 4390 :: 1304

1304

5814)5724560(984 *Sh.*

3584 *l.* 49 : 4 : 7 ¼ *C*'s Share.

12

5814)43008(7 *d.*

2310

4

5814)9240(1 *f.*

3426

	l.	*s.*	*d.*
A's Share of the Gain - - -	60	15	8
B's - - - - - - - -	109	9	8 ½
C's - - - - - - - -	49	4	7 ¼
Proof - - - £.	219	9	11 ¾

Decimally.

5814)219.500000(.037753

4058

.037753	.037753	.037753
1610	2900	1304
£. 60.782330	£. 109.483700	£. 49.229912
20	20	20
Sh. 15.646600	*Sh.* 9.674000	*Sh.* 4.598240
12	12	12
d. 7.759200	*d.* 8.088000	*d.* 7.178880
4		
f. 3.036800		

30. Three

30. Three Merchants accompany. *A* put in *January* 1, 137 *l.* 10 *s.* and *April* 9, he put in more 36 *l.* 14 *s.* 6 *d.* *B* put in *January* 1, 257 *l.* and takes out *May* 15, 119 *l.* 14 *s.* *C* put in *January* 1, 119 *l.* 18 *s.* 9 *d.* *March* 19, he put in more 227 *l.* and takes out *September* 27, 195 *l.* 18 *s.* 3 *d.* At the Year's End they cast up their Stock, and found they had lost by trading 359 *l.* 18 *s.* 10 *d.* I demand each Man's Share of the Loss.

	l. *s.* *days.*	*l.* *s.* *d.* *days*	
A had in Stock	137 : 10, 99 .	and 174 : 4 : 6, 266	
137 10	20	20	
36 14 6			*Jan.* 31
174 4 6	2750	3484	*Feb.* 28
	12	12	*Mar.* 31
	33000	41814	*April* 9
	99	266	99
	3267000	11122524	365
	11122524		266
	14389524 *A*'s Stock and Time.		

	l. *days.*	*l.* *s.* *days.*	
B had in Stock	257, 135 .	and 137 : 6, 230	
257	20	20	
119 14			*Jan.* 31
137 6	5140	2746	*Feb.* 28
	12	12	*Mar.* 31
			Apr. 9
	61680	32952	*May* 15
	135	230	
	8326800	7578960	135
	7578960		365
	15905760 *B*'s Stock and Time.		230

C had

	l.	*s.*	*d.*	*days.*		*l.*	*s.*	*d.*	*days*
C had in Stock	119	18	9,	78	and	346	18	9,	192

119 18 9
227 00 0
346 18 9
195 18 3
151 00 6

119 : 18 : 9
20
2398
12
28785
78
2245230

346 : 18 : 9
20
6938
12
83265
192
15986880

Jan. 31
Feb. 28
Mar. 19
78

	l.	*s.*	*d.*	*days*
Likewise *C* had in Stock	151	00	6	95

Mar. 12
April 30
May 31
June 30
July 31
Sept. 27
192
78
270
365
95

151 : 00 : 6
20
3020
12
36246
95
3443370
15986880
2245230
21675480 *C*'s Stock and Time
15905760 *B*'s Stock and Time
14389524 *A*'s Stock and Time
Total - - 51970764

	l.	*s.*	*d.*
Loss	359	18	10

359 18 10
20
7198
12
86386 *d.*

Pence.

If 51970764 . . 86386 : : 14389524
86386

51970764)1243053420264(23918 *d.*
16686912
4
51970764)66747648(1 *f.*
14776884

23918 *d.*
199|3 : 2
l. 99 : 13 : $2\frac{1}{4}$

If

Pence.

If 51970764 . . 86386 : : 15905760
86386

51970764)1374034983360(26438 *d.*
31924728 220|3 : 2
4
110 : 3 : 2½
51970764)127698912(2 *f.*

If 51970764 . . 86386 : 21675480
86386

51970764)1872458015280(36029 *d.*
3359124 300|2 : 5
4
l. 150 : 2 : 5
13436496

	l.	*s.*	*d.*
A's Share of the Lofs - -	99	13	2¼
B's - - - - - - -	110	3	2½
C's - - - - - - -	150	2	5
Proof - - - -	359	18	9¼

s. *d.* *Decimally.*

10 : 0 is $\frac{10}{20}$ or $\frac{1}{2}$ of a £.
14 : 6 is 174 *d.* that is, $\frac{174}{240}$ or $\frac{29}{40}$ of a £.
14 : 0 is $\frac{14}{20}$ or $\frac{7}{10}$ of a £.
18 : 9 is 225 *d.* that is, $\frac{225}{240}$ or $\frac{75}{80}$ of a £.
18 : 3 is 219 *d.* that is, $\frac{219}{240}$ or $\frac{73}{80}$ of a £.
18 : 10 is 226 *d.* that is, $\frac{226}{240}$ or $\frac{113}{120}$ of a £.

1 .5 29 .725 75 .9375
|21.0 40|29.000 80|75.0000

73 .9125 113 .941666666
80|73.0000 120|113.00000000
80

	£.	Days.		£.	Days.
A had in Stock	137.5	: 99	and	174.225	: 266

137.5
36.725
174.225

137.5 × 99 = 13612.5
174.225 × 266 = 46343.850

13612.5
46343.85
59956.35 *A*'s Stock and Time.

	£.	Days.		£.	Days.
B had in Stock	257	: 135	and	137.3	: 230

257
119.7
137.3

257 × 135 = 34695
137.3 × 230 = 31579.0

34695
31579
66274 *B*'s Stock and Time.

	£.	Days.		£.	Days.
C had in Stock	119.9375	: 78	and	346.2375	: 192

119.9375 × 78 = 9355.1250
346.2375 × 192 = 66612.0000

	£.	Days.
Likewise *C* had in Stock	151.025	: 95

119.9375
227
346.9375
195.9125
151.0250

151.025 × 95 = 14347.375

14347.375
9355.125
66612.
90314.500

59956.35 *A*'s Stock and Time.
66274. *B*'s Stock and Time.
90314.5 *C*'s Stock and Time.
216544.85) 359.941666666 (.0016622

```
  .0016622              .0016622
  59956.35                 66274
------------         -------------
£. 99.659444970      £. 110.1606428
            20                   20
------------         -------------
Sh. 13.188899400     Sh. 3.2128560
            12                   12
------------         -------------
d. 2.266792800       d. 2.5542720
             4                    4
------------         -------------
f. 1.067171200       f. 2.2170880

            .0016622
            90314.5
          -----------
       £. 150.12076190
                   20
          -----------
      Sh. 2.41523800
                   12
          -----------
       d. 4.98285600
                    4
          -----------
       f. 3.93142400
```

31. At 5 *per Cent. per Ann.* What is the *Interest* of 3752 *l.* forborn 9 *Years* ?

First, I find what is the *Interest* of it for *One* Year.

```
     £.        £.       £.
If 100 - - -   5  ::  3752
                         5
                    ------
               100)18760(187 £.
                    ------
                       60
                       20
                    ------
               100)1200(12 Sh.
```

	year.		l.	s.		years.
If	1	- - -	187 :	12	::	9
			20			
			3752			
			9			

2|0)3376|8 *Shillings*.

£. 1688 : 8 The Interest of 9 Years.

Decimally.

If the Sum of Money be multiplied by the *Rate of Interest*, made so many *Decimal* Parts of 100, the *Product* will be the *Interest* of *One* Year, which multiplied by the *Time*, gives the *Interest* for the Time required.

£.
3752
.05

£. 187.60 The Interest of 1 Year.
9

£. 1688.40 The Interest of 9 Years.
20

Sh. 8.00

32. At

32. At 6 *per Cent. per Ann.* What is the *Interest* of 354*l.* 14*s.* 7*d.* forborn 7 *Years*, 25 Days.

```
   l.           l.      l.   s.   d.
If 100 - - -    6  ::  354 : 14 : 7
    20                  20
  ----                 ----
  2000                 7094
    12                   12
  -----                -----
 24000                 85135
                           6
                     -------
         2400|0)51081|0(21 l.
                 -----
                  681
                   20
                 -----
           240|0)1362|0(5 s.
                 -----
                  162
                   12
                 -----  d.
             240)1944(8 24/240 = 1/10
                 ----
                   24

days.     l.   s.   d.     years. days.
If 365 - - 21 : 5 : 8  ::  7 : 25
           20            365
          ----           ----
           425           2580
            12           5108
        ------  -----------
          5108  365)13178640(36105 Pence,
                                  -----
                     315        300|8 : 9
                       4        -----
                    ----        150 : 8 : 9
               365)1260(3 165/365 = 33/73
                   ----
                    165
```

 Decimally.

Decimally.

14*s.* 7*d.* is 175 *Pence*, that is, $\frac{175}{240}$ or $\frac{35}{48}$ of a £.
25 *Days* is $\frac{25}{365}$ or $\frac{5}{73}$ of a *Year*.

$$\frac{35}{48}\;\; 48)35.000000(.729166 \qquad \frac{5}{73}\;\; 73)5.000000(.068493$$

	£.
	354.729166
	.06
Interest of 1 Year:	21.28374996
	7.068493
	£. 150.44403760601028
	20
	Sh. 8.880752
	12
	d. 10.569024
	4
	f. 2.276096

The Excess in this Operation proceeds from the $\frac{1}{10}$ of a *Penny*, which the former takes not in.

If $\frac{1}{4}$ $\frac{1}{2}$ or $\frac{3}{4}$ be annexed to the Rate of Interest, then 25, 5, or 75, must also be annexed in the *Decimal* Operation. That is, If the Rate of *Interest* be 5 $\frac{1}{4}$, then the Money must be multiplied by .0525 for the *Interest* of 1 Year. If it should be 5 $\frac{1}{2}$, or 5 $\frac{3}{4}$, then by .055, or .0575; understand the like for any other Rate of *Interest*.

Some *Bankers* compute the *Interest* of *Money* by the following Rule, *viz.* Multiply the Sum of Money by the Number of Days it is out at Interest, for a Dividend; and then divide 36500 (the Days in a Year multiplied by 100) by the Rate of *Interest* for a *Divisor*.

Quest.

	Days.	£.
Quest. 31.	365	3752 Principal.
	9	3285 Days at Int.
5|36500	3285	730|0)1232532|0(1688*l.*
7300		292
		20
		73|0)584|0(8*s.*

		l. : *s.* : *d.*
Quest. 32.		354 : 14 : 7 Principal.
yea. *days.*		20
7 : 25		7094
365	6|36500	12
2580	6083	85135 *Pence.*
		2580

6083)219648300(36108 *Pence.*

3336   300\|9

£. 150 : 09

The Excess in this Operation proceeds from the *Divisor*, which, if it had been carry'd on with some *Decimal* Parts annexed thereunto, would have been 6083·3333·

33. At 6 *per Cent. per Annum*, What comes 282*l.* 15*s.* 6*d.* to, forborn *Five* Years, allowing *Interest* upon *Interest*?

RULE.

First find the *Interest* of the Money for the *first* Year, and add it to the *Principal*; and find the *Interest* thereof for the next Year; and so proceed to the End of the Time required.

```
     l.       l.      l.    s.   d.
If 100 . . 6 :: 282 : 15 : 6
      20      20       20
   ------  -----  ------
    2000    120    5655
      12     12      12
   ------  -----  ------
   24000   1440   67866
       4      4       4
   ------  -----  ------
   96000   5760  271464
             Mult. 5760
           ---------------
   96000)1563632640(16287 f.
                 ---------
                  80640

  To 271464
  Add 16287
     ------
     287751

If 96000 . . 5760 :: 287751
                        5760
                  -----------
           96000)1657445760(17265 f.
                        -----
                         5760

  To 287751
  Add 17265
     ------
     305016

If 96000 . . 5760 :: 305016
                        5760
                 ------------
          96000)1756892160(18300 f.
                     --------
                     92160

   To 305016
  Add  18300
      ------
      323316
```

If

If 96000 . . 5760 : : 323316
5760

96000)1862300160(19398 *f*.
92160

To 323316
Add 19398

342714

If 96000 . . 5760 : : 342714
5760

96000)1974032640(20562
80640

To 342714
Add 20562

4|363276

12|90819

2|0)756(8 : 3

Anſwer £. 378 : 8 : 3

This Method of working *Intereſt* upon *Intereſt* will be found very troubleſome and tedious, eſpecially when required for many Years; I will therefore ſhew you a Method much more compendious and eaſy, that will ſave all the Operations in the *Golden Rule.*

RULE.

Reduce the *Principal* Money into *Farthings*, and multiply it by the *Rate* of Intereſt; cut off two Figures in the *Product*; the *reſt* are the *Intereſt* of the *firſt* Year in *Farthings*; and ſo proceed for every Year required.

	l.	s.	d.
	282	15	6

	20	
	5655	
	12	
	67866	
	4	
	271464	
1st Year's Interest	16287	84
	287751	
2d Year's Interest	17265	06
	305016	
3d Year's Interest	18300	96
	323316	
4th Year's Interest	19398	96
	342714	
5th Year's Interest	20562	84
	4|363276	
	12|90819	
	2|0)756(8 : 3	

£. 378 : 8 : 3 as afore.

Decimally.

Decimally.

15 *s.* 6 *d.* is 186 *d.* that is, $\frac{186}{240}$ or $\frac{31}{40}$ of a £.

$\frac{31}{40}$ = .775 (40)31.000		£. 282.775
		.06
Interest of the 1st Year		16.96650
	Add	282.775
		299.74150
		.06
Interest of the 2d Year		17.9844900
	Add	299.74150
		317.7259900
		.06
Interest of the 3d Year		19.063559400
	Add	317.72599
		336.789549400
		.06
Interest of the 4th Year		20.20737296400
	Add	336.7895494
		356.99692236400
		.06
Interest of the 5th Year		21.4198153418400
	Add	356.99692236400
	£.	378.4167377058400
		20
	Sh.	8.334754116800
		12
	d.	4.017049401600

This

This Operation alſo may be very much contracted, if in multiplying by the *Rate* of *Intereſt* made ſo many *Decimal* Parts of 100, you cut off two Figures in the *Product*.

Note: *Three Cyphers* are annexed to the *Decimal* Parts of the *Principal*, that ſo *ſix Decimal* Places may be retained throughout the Operation.

	£.	
	282.775000	
	16.966500	00
	299.741500	
	17.984490	00
	317.725990	
	19.063559	40
	336.789549	
	20.207372	94
	356.996921	
	21.419815	26
£.	378.416736	
	20	
Sh.	8.334720	
	12	
d.	4.016640	

Theſe *Decimal* Operations takes in the ſeveral *Remainders*, which the *Vulgar* does not; and from hence comes the Difference between them.

34. At 5 *per Cent. per Annum*, what will 278 *l.* 13 *s.* 4 *d.* amount to, forborn 11 *Years*, allowing *Intereſt* upon *Intereſt*?

	l. *s.* *d.*	
	278 : 13 : 4	
	20	
	5573	
	12	
	66880	
	4	
	267520	
	13376	00
1st Year	280896	
	14044	80
2d ——	294940	
	14747	00
3d ——	309687	
	15484	35
4th ——	325171	
	16258	55
5th ——	341429	
	17071	45
6th ——	358500	
	17925	00
7th ——	376425	
	18821	25
8th ——	395246	
	19762	30
9th ——	415008	
	20750	40
10th ——	435758	
	21787	90
11th ——	457545	
	12|114386	
	2|0)953(2 : 2	
	£. 476 : 12 : 2	

Decimally.

13*s.* 4*d.* is $\frac{160}{240}$ or $\frac{2}{3}$ of a £.

	2 .666666	
	3|2.000000	
	2	
	£. 278.666666	
	13.933333	3
1st Year	292.599999	
	14,629999	95
2d ——	307.229998	
	15.361499	90
3d ——	322.591497	
	16.129574	85
4th ——	338.721071	
	16.936053	55
5th ——	355.657124	
	17.782856	20
6th ——	373.439980	
	18.671999	00
7th ——	392.111979	
	19.605598	95
8th ——	411.717577	
	20.585878	85
9th ——	432.303455	
	21.615172	75
10th ——	453.918627	
	22.695931	35
11th £.	476.614558	
	20	
Sh.	12.291160	
	12	
d.	3.493920	
	4	
f.	1.975680	

Tho' this Kind of *Interest* is counted very unlawful by many, yet it is easy to make it appear, that it is far more reasonable, than that which is called *Simple Interest*; for what is more unjust, than after the Rate of 6 *per Cent.* to take 3 *l.* for *half* a Year, or 30 *s.* for a *Quarter*, when 3 *l.* will give in *half* a Year 1 *s.* 9 *d.* $\frac{1}{2}$?

But in *Leases*, *Reversions*, *Annuities*, *&c.* it is far more unreasonable, as divers can by Experience witness, who compounding according to the Rules of *Simple Interest*, have paid more for their *Tenements*, *Annuities*, *Leases in Reversion*, *&c.* than they have been really worth, as will appear in the three following Questions.

35. What is 289 *l.* 15 *s.* 6 *d.* payable at the End of 7 *Years*, worth in *ready Money*, discounting after the Rate of 6 *per Cent.*

First: Find the *Interest* of 100 *l.* for the Time mentioned.

Then, as 100 *l.* with the *Interest*, is to 100 *l.* so is the *Debt* to be paid, to its Worth in *ready Money*.

6 *l.* the Interest of 100 *l.* for a Year.

$\frac{7}{42}$ *l.* the Interest of 100 *l.* for 7 Years.

```
     l.        l.      l.    s.   d.
If 142  . .  100 :: 289  :  15  :  6
     20               20
   ----             ----
   2840             5785
     12               12
  -----            -----
  34080            69426
                     100
            ------------
      3408|0)694260|0(204 £.
                228
                 20
               ----
          3408)4560(1 Sh.
               1152
                 12
               ----
          3408)13824(4 d.
```

Decimally.

15 *s.* 6 *d.* is 186 *d.* that is, $\frac{186}{240}$ or $\frac{31}{40}$ of a £.

$$\frac{31}{40}\Big|\,31.000\;(.775$$

	£.		£.		£.
If	142	- -	100	: :	289.775
					100

142)28977.500(204.0669 £.

20

Sh. 1.3380

12

d. 4.0560

To find the Worth of the ſaid Sum of Money, allowing *Intereſt* upon *Intereſt*.

	100 £.	
	20	
	2000	
	12	
	24000	
	4	
	96000	
1 Yea. Int.	5760	00
	101760	
2d - - -	6105	00
	107865	
3d - - -	6471	90
	114336	
4th - - -	6860	16
	121196	
5th - - -	7271	76
	128467	
6th - - -	7708	02
	136175	
7th - - -	8170	50
	144345 *f.*	

Decim a lly.

	100.000000	
1 Yea. Int.	6.000000	00
	106.000000	
2d - - -	6.360000	00
	112.360000	
3d - - -	6.741600	00
	119.101600	
4th - - -	7.146096	00
	126.247696	
5th - - -	7.574861	76
	133.822557	
6th - - -	8.029353	42
	141.851910	
7th - - -	8.511114	60
£.	150.363024	

	Farth.		*Farth.*		*l.*	*s.*	*d.*
If	144345	. .	96000	: :	289 :	15 :	6

```
                            20
  4|185012             ________
  ________                5795
 12|46253                   12
  ________             ________
    385'4 : 5             69546
    ___                       4
 £. 192 : 14 : 5       ________
                         278184
                          96000
                ________________
        144345)26705664000(185012 f.
```

Decimally.

```
    £.          £.       £.
If 150.363 - 100 : : 289.775
                           100
        150,363)28977.50000000(192.71695 £.
                                       20
                                 ________
                          Sh. 14.33900
                                       12
                                 ________
                           d. 4.06800
```

	l.	*s.*	*d.*
The Purchase by Simple Interest	204	01	4
By Compound Interest - -	192	14	4
The Difference - - -	11	07	0

Thus you see, how much those wrong themselves, who purchase, and compound by the Rules of *Simple Interest.*

36. What is 728 *l.* 16 *s.* 8 *d.* payable at the End of 5 ½ *Years*, worth in *ready Money*, compounding after the Rate of 5 *per Cent.*

5 *l.* the Interest of 100 *l.* for 1 Year.
5
25 *l.* the Interest of 100 *l.* for 5 Years.
2 *l.* --- 10 *s.* the Interest of half a Year.
27 *l.* 10 *s.* the Interest of 5 ½ Years.

$$\begin{array}{l}
\quad\ \ l.\quad s.\qquad l.\qquad l.\quad s.\ \ d.\\
\text{If } 127 : 10 \ .\ .\ 100 :: 728 ; 16 : 8
\end{array}$$

$$\begin{array}{r}
20\\ \hline
2550\\
12\\ \hline
30600
\end{array}
\qquad
\begin{array}{r}
20\\ \hline
14576\\
12\\ \hline
174920\\
100\\ \hline
17492000
\end{array}$$

$$\begin{array}{l}
306|00)174920|00(571\ £.\\
\qquad\qquad 194\\
\qquad\qquad\ \ 20\\
\qquad 306)3880(12\ s.\\
\qquad\qquad 208\\
\qquad\qquad\ \ 12\\
\qquad 306)2496(8\ d.\\
\qquad\qquad\ \ 48
\end{array}$$

Years. *Decimally.*

$$\begin{array}{r}
5.5\\
.5\\ \hline
27.5
\end{array}$$
the Interest of 100 *l.* for $5\frac{1}{2}$ Years.

16 *s.* 8 *d.* is 200 *d.* that is, $\frac{200}{240}$ or $\frac{5}{6}$ of a £.

$$\begin{array}{r}
\frac{5}{6}|\underline{5.0000000}\\
.8333333
\end{array}$$

$$\begin{array}{l}
\qquad £.\qquad\quad £.\qquad\qquad £.\\
\text{If } 127.5 \ \text{- -}\ 100 \ \text{- -}\ 728.8333333\\
\qquad\qquad\qquad\qquad\qquad\qquad 100\\ \hline
\qquad\qquad\qquad\qquad 72883.3333300
\end{array}$$

$$\begin{array}{r}
£.\qquad\qquad\\
127.5)72883.3333300(571.633986\\
1150\qquad\qquad\qquad 20\\ \hline
Sh.\ 12.679720\\
12\\ \hline
d.\ 8.156640
\end{array}$$

Interest upon Interest.

£.
100
20
200120
24000
4
96000
1st Year's Int. 4800 | 00
100800
2d - - - - - - 5040 | 00
105840
3d - - - - - - 5292 | 00
111132
4th - - - - - 5556 | 60
116688
5th - - - - - 5834 | 40
122522
6th - - - - 2)6126 | 10
3063
122522
125585

Decimally.

£.
100.000000
5.000000 | 00
105.000000
5.250000 | 00
110.250000
5.512500 | 00
115.762500
5.788125 | 00
121.550625
6.077531 | 25
127.628156
2)6.381407 | 80
3.190703
127.628156
130.818859

Far.	*Far.*	*l.*	*s.*	*d.*
If 125585 . .	96000 : :	728 :	16 :	8

20
14576
12
174920
4
699680
96000
125585)67169280000(534851 *f.*
Rem. 17165 133712 : 3
1114|2 : 8
£. 557 : 2 : 8 ¾

	£.		£.		£.
If	130.818859	- -	100	: :	728.833333333333
					100

£.
130.818859)72883.3333333300(557.131708

Rem. 94315544

	20
Sh.	2.634160
	12
d.	7.609920
	4
f.	2.439680

	l.	*s.*	*d.*
Thus you ſee the Purchaſe by Simple Intereſt is - - - - -	571	12	8
By Compound Intereſt - - -	557	2	8
The Difference - - £.	14	10	0

Note: To anſwer this Queſtion exactly, a mean Proportion, ſhould have been found between the *Intereſt* and *Principal* of the 5th *Year*, and the *Intereſt* and *Principal* of the *ſixth* Year, for the odd half Year; but becauſe that is not to be performed, without the *Square Root*, therefore I take half the *Intereſt* of the *ſixth* Year, and add it to the *Principal* of the 5th *Year*; which tho' it be not exact, according to the Rules of *Compound Intereſt*, yet its Difference is leſs than a *Shilling*, therefore inconſiderable, and may in Practice be uſed.

37. How much *ready Money* will purchaſe an *Annuity* of 59 *l.* to continue 5 *Years*, after the Rate of 6 *per Cent.* Diſcount?

If

£. £. £.
If 106 . . 100 : : 59
59
106)5900(55 *l.*
70
20
106)1400(13 *s.*
22
12
106)264(2 *d.*
52
4
106)208(1 *f.*
102

£. £. £.
If 112 . . 100 : : 59
59
112)5900(52 *l.*
76
20
112)1520(13 *s.*
64
12
112)768(6 *d.*
96
4
112)384(3 *f.*
48

£. £. £.
If 118 . . 100 : : 59
59
118)5900(50 *l.*
0

£. £. £.
If 124 . . 100 : : 59
59
124)5900(47 *l.*
72
20
124)1440(11 *s.*
76
12
124)912(7 *d.*
44
4
124)176(1 *f.*
52

£. £. £.
If 130 . . 100 : : 59
59
13|0)590|0(45 *l.*
5
20
13)100(7 *s.*
9
12
13)108(8 *d.*
4
4
13)16(1 *f.*
3

The first Year's Purchase is - - -	55	13	2	1
The second Year's - - - - - - - -	52	13	6	3
The third - - - - - - - - - - - - -	50	-	-	-
The fourth - - - - - - - - - - - -	47	11	7	1
The fifth - - - - - - - - - - - - -	45	7	8	1
The Purchase of the whole - - £.	251	06	0	2

Decimally.

£. £. £.
If 106 . . 100 :: 59
59

£.
106)5900.000000(55.660377
38

£. £. £.
If 112 . . 100 :: 59
59

£.
112)5900.000000(52.678571

£. £. £.
If 118 . . 100 :: 59
59

£.
118)5900.000000(50
0

£. £. £.
If 124 . . 100 :: 59
59

£.
124)5900.000000(47.580645
20

£. £. £.
If 130 . . 100 :: 59
59

£.
130)5900.000000(45.384615

	£.
First Year's Purchase -	55.660377
Second - - - - - - - - - -	52.678571
Third - - - - - - - - - -	50. - - -
Fourth - - - - - - - - - -	47.580645
Fifth - - - - - - - - - -	45.384615
	£. 251.304208
	20
	Sh. 6.084160
	12
	1.009920

Interest upon Interest.

	59 £.	:	100 £.	
	20		20	
	1180		2000	
	12		12	
	14160	: :	24000	
	4		4	
Farthings	56640		96000	*Farthings.*
			5760	00
Int. & Princ. of the 1st Ye.			101760	
			6105	60
of the 2d . .			107865	
			6471	90
of the 3d . .			114336	
			6860	16
of the 4th . .			121196	
			7271	36
of the 5th . .			128467	

If

F.	F.	F.
If 101760 . .	96000 ::	56640

$$\begin{array}{r} 56640 \\ 96000 \\ \hline 101760)5437440000(53433 \\ 97920 \end{array}$$

F.	F.	F.
If 107865 . .	96000 ::	56640

$$\begin{array}{r} 56640 \\ 96000 \\ \hline 107865)5437440000(50409 \\ 73215 \end{array}$$

F.	F.	F.
If 114336 . .	96000 ::	56640

$$\begin{array}{r} 56640 \\ 96000 \\ \hline 114336)5437440000(47556 \\ 77184 \end{array}$$

F.	F.	F.
If 121196 . .	96000 ::	56640

$$\begin{array}{r} 56640 \\ 96000 \\ \hline 121196)5437440000(44864 \\ 102656 \end{array}$$

F.	F.	F.
If 128467 . .	96000 ::	56640

$$\begin{array}{r} 56640 \\ 96000 \\ \hline 128467)5437440000(42325 \\ 74225 \end{array}$$

	Farthings.
The First Year's Purchase - - -	53433
The Second Year - - - - - - - -	50409
The Third Year - - - - - - - -	47556
The Fourth Year - - - - - - - -	44864
The Fifth Year - - - - - - - - -	42325

$$\begin{array}{r} 4)\overline{238587} \\ 12)\overline{59646}\ \tfrac{3}{4} \\ 497|0 : 6 \\ £.\ 248 : 10 : 6\tfrac{3}{4} \end{array}$$

Decimally.

	£.	
	100.000000	
	6.000000	00
Int. and Prin. of the first Year	106.000000	
	6.360000	00
Of the second - -	112.360000	
	6.741600	00
Of the third - -	119.101600	
	7.146096	00
Of the fourth - -	126.247696	
	7.574861	76
Of the fifth - - £.	133.822557	

£. £. £.
If 106 . . 100 : : 59
59

106)5900.000000(55.660377
38

£. £. £.
If 112.36 . . 100 : : 59
59

112.36)5900.00000000(52.509789
10796

£. £. £.
If 119.1016 . . 100 : : 59
59

119.1016)5900.0000000000(49.537537
832408

If

If 126.247696 . . 100 : : 59
59

126.247696)5900.000000000000(46.733526

£. £. £.
If 133.822557 . . 100 : : 59
59

133.82257)5900.000000000000(44.088232

	£.
The first Year's Purchase - - - -	55.660377
The second - - - - - - - -	52.509789
The third - - - - - - - - -	49.537537
The fourth - - - - - - - - -	46.733526
The fifth - - - - - - - - -	44.088232
£.	248.529461
	20
Sh.	10.589220
	12
d.	7.070640

The Purchase by Simple Interest - £.	251	6	1
By Compound Interest - - £.	248	10	7
Difference - - - - - - £.	2	15	6

38. One Man owes another the Sum of 350 *l.* to be paid in Manner following, *viz.* the Sum of 70 *l.* in 6 *Months*, and so every 6 *Months* following the Sum of 70 *l.* until the Whole be paid. Now it is agreed between both to pay the Whole at one Payment; I demand the Time of Payment.

Note: When the *Sums* of Money and *Times* of Payment are *equal*, as in this Question, by adding one Term of Time more, and taking half thereof, you have the *equated* Time of Payment.

70 £.

70 £. in 6 Months.
70 £. in 6 Months following.
70 £. in 6 Months after the preceeding.
70 £. in 6 Months after that.
70 £. in 6 Months following.
6 Months more added.

350 £.

2|36

18 Months the Time of Payment.

39. One Man is indebted to another 20 *Shillings*, to be paid at *one Shilling per Week*. What is the Time of Payment to pay the Whole at once?

20
1 Week more added.

2|21

10 ½ Weeks the Time of Payment.

From hence may be observed, the great *Extortion* of those *Usurers*, who lend 18 *Shillings*, to receive again 20, at *one Shilling per Week*.

W. *D.* *W.*
A Year is 52 : 1 *Decimally*, 52.142857

W. *Sh.* *W.*
If 10.5 . . 2 : : 52.142857
2

10.5)104.285714(9.93197 *Sh.*

18 *Shillings* lent, is $\frac{9}{10}$ of a £.

If

£.	Sh.		£.
If .9	..	9.93197 ::	100

$$
\begin{array}{r}
100 \\
\hline
.9|993.19700 \\
\hline
Sh.\ 1103.5522 \\
12 \\
\hline
d.\ 6.6264 \\
\hline
f.\ 2.5056
\end{array}
\qquad
\begin{array}{r}
2{,}0)110|3 \\
\hline
£.\ 55 : 3
\end{array}
$$

Thus it appears, that those who practise this unreasonable Way of letting out Money to Use, gain 55 *l.* 3 *s.* 6 *d.* ½ for every 100 *l.* they so let out. No Wonder then, that such heap up great Possessions; but let them remember, it is heaped together for the last Days.

40. One Merchant owes to another 1500 *l.* to be paid in Manner following, *viz.* 300 *l.* at 6 *Months*; 300 *l.* more at 10 *Months*; 300 *l.* more at 12 *Months*; 300 *l.* more at 18 *Months*; and 300 *l.* more at 24 *Months*. I demand the Time of paying it altogether?

Note: If the *Sums* of Money or *Times* of Payment be different, then each Sum must be multiplied by its Time of Payment; and the *Total* divided by the *Debt*, the Quotient gives the *equated* Time of Payment.

300 *l.* at 6 Months.
$$\begin{array}{r} 6 \\ \hline 1800 \end{array}$$

300 *l.* at 10 Months.
$$\begin{array}{r} 10 \\ \hline 3000 \end{array}$$

300 *l.* at 12 Months.
$$\begin{array}{r} 12 \\ \hline 3600 \end{array}$$

300 *l.* at 18 Months.
$$\begin{array}{r} 18 \\ \hline 5400 \end{array}$$

300 *l.*

300 *l.* at 24 Months.

24	
7200	1800
	3000
	3600
	5400
	7200

15|00)210(00|14 Mon. the Time of Payment.

41. Suppose 477 *l.* to be paid in Manner following, *viz.* 47 *l. ready Money*; 20 *l.* at 3 *Months*; 60 *l.* at 6 *Months*; 100 *l.* at 9 *Months*; 100 *l.* at 12 *Months*; 150 *l.* at 15 *Months*; when would be the Time of paying it at one Payment?

20 *l.* at 3 Months. 60 *l.* at 6 Months.

3	6
60	360

100 *l.* at 9 Months. 100 *l.* at 12 Months.

9	12	
900	1200	60

150 *l.* at 15 Months.

	360
15	900
	1200
2250	2250

477)4770(10 Mon. the Time of Payment.

These Rules on *Equation of Payments*, resolve the Question exactly, according to the Rules of Simple Interest; for in Question 38,

	l.	*s.*	*d.*
The Interest of 70 *l.* for 6 Months is	2	2	0
12 Months - -	4	4	0
18 Months - -	6	6	0
24 Months - -	8	8	0
30 Months -	10	10	0
Total £.	31	10	0

	l.	s.	d.
So likewise the Interest of 350 *l.* for 18 Months is - - - - - - - -	31	10	0

Again, in Question 40,	l.	s.	d.
The Interest of 300 *l.* for 6 Months is -	9	0	0
10 Months - -	15	0	0
12 Months - -	18	0	0
18 Months - -	27	0	0
24 Months - -	36	0	0
Total - - £.	105	0	0
Which agrees with the Interest of 1500 *l.* for 4 Months, that comes to	105	0	0

But to answer these Questions exactly, is by the Rebate, and not by the Interest of the Money.

For in Question 38,	l.	s.	d.
The Rebate of 70 *l.* for 6 Months is -	2	0	9 ½
12 Months - -	3	19	3
18 Months - -	5	15	8 ¼
24 Months - -	7	10	0
30 Months - -	9	2	7 ½
Total - - £.	28	8	4 ¼
The Rebate of 350 *l.* for 18 Months is	28	18	0
Difference - -	0	9	7 ¼

So that the Time of Payment must not be full 18 Months, but must want 8.346 Days, in which Time the Interest of 350 *l.* comes to the Difference, *viz.* 9 *s.* 7 *d.* ¼

	l.	s.	d.
Again, in Question 40,			
The Rebate of 300 *l.* for 6 Months is -	8	14	9¼
10 Months - -	14	5	8¾
12 Months - -	16	19	7½
18 Months - -	24	15	5
24 Months - -	32	2	10½
Total - - £.	96	18	5
The Rebate of 2500 *l* for 14 Months is	98	2	7½
Difference - -	1	4	2½

So that the Time of Payment must not be 14 Months, by 4.908 Days; in which Time the Interest of 1500 *l.* will amount to the Difference, *viz.* 1 *l.* 4 *s.* 2 *d.* ½

Thus, tho' the aforesaid Rules for finding the equated Time of Payment be not exact, according to the Rules of *Rebate*; yet they come very near it, and may be used as a good Help to find the exact Time of Payment, which otherwise will be very difficult to resolve.

The End of the First Part.

THE

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M.DCC.XLVI.

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LONDON:

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THE

Arithmetician's Guide.

PART II.

ALGEBRA,

CALLED by some the *Analytic Art* and universal Mathematicks, was first invented by *Francis Vieta*, but since, by the Labours of several eminent Persons, it has not only found very great Improvements, but has in a Manner been brought to the very Heighth of Perfection.

It is divided into Two Parts, *viz.* *Numerical* and *Literal*: The former of which is more ancient, and the latter more modern; and the Difference between the two consists chiefly in this, That in every Problem, the *Literal* does not only find out the very Thing sought for, as the *Numerical* does, but at the same Time discovers a general Rule, and Mode of Construction; which the *Numerical* cannot do, because all the Footsteps of the Process are confounded and lost in it, which the *Literal* always keeps entire, that they may be readily made use of back again, in order to *Composition*.

The following Signs, or Characters, are used in this Art.

$+$ *More*, the Sign of *Addition*.

$-$ *Less*, the Sign of *Subtraction*.

$\times$ *Mul-*

× *Multiply*, the Sign of *Multiplication*.
= *Equal*, the Sign of *Equality*.
√ *Root*, the Sign of the *Root* of any Quantity.
∴ *Therefore*.
⊏ *Greater*.
⊐ *Lesser*.

Note: When *two* or more Letters are joined together, without any Sign betwixt them, they are supposed to be *multiplied* together.

Division is expressed by a Line, like a *Fraction*, the *Numerator* shewing the *Dividend*, and the *Denominator* the *Divisor*.

And this is carefully to be observed, that the *Quantity*, that hath no Sign before it, if it be the *leading* Quantity, it is to be understood, to have the Sign +.

Axioms.

1. If *equal* Quantities be added to *equal* Quantities, the Sum shall be *equal*.
2. If *equal* Quantities be taken from *equal* Quantities, the Remainders shall be *equal*.
3. If *equal* Quantities be multiplied with *equal* Quantities, the Products will be *equal*.
4. If *equal* Quantities be divided by *equal* Quantities, the Quotients will be *equal*.
5. Those Quantities that are *equal* to one and the same Thing, are also *equal* to one another.

ADDITION

JOINS together all proposed *Quantities*, keeping the same Signs + and —.

If the Signs are different, *Addition* is performed by *Subtraction*; for *Quantities* of the same Name, being

being affected by contrary Signs, in *Addition*, destroy one another.

In *Simple Quantities* of the same Kind.

To	$2a$	a	$3d$	$-5c$
Add	a	$-a$	$5d$	$-2c$
Sum	$3a$	0	$8d$	$-7c$

To	$5b$	$7m$	$4b$	$11e$
Add	$-3b$	$-9m$	$2b$	$-2e$
Sum	$2b$	$-2m$	$6b$	$9e$

In *Simple Quantities* of a different Kind.

To	a	$4c$	$3c$
Add	b	$2d$	$2e$
Sum	$a+b$	$4c+2d$	$3c+2e$

To	b	$4a$	$2d$
Add	$-a$	1	-2
Sum	$b-a$	$4a+1$	$2d-2$

In *Compound Quantities* of the same Kind.

To	$2a+4d$	$3c+2a$	$5b-3c$
Add	$a+5d$	$8c+4a$	$7c-2b$
Sum	$3a+9d$	$11c+6a$	$3b+4c$

To	$a+b-2c$	$bb+2abc-ab+ac$
Add	$a-b+3c$	$bb-abc+ab-3ac$
Sum	$2a+c$	$2bb+abc-2ac$

In

In *Compound Quantities* of a different Kind.

$$\begin{array}{lll} \text{To} & 3a + c & 5d - 4c + 2a \\ \text{Add} & 2b + d & 2b - e - 4n \\ \hline \text{Sum} & 3a + c + 2b + d & 5d - 4c + 2a + 2b - e - 4n \end{array}$$

$$\begin{array}{ll} \text{To} & 5a - 3b + 4c - d \\ \text{Add} & 5e + 3i - 2m + 4n \\ \hline \text{Sum} & 5a - 3b + 4c - d + 5e + 3i - 2m + 4n \end{array}$$

In *Compomnd Quantities* of a mix'd Kind.

$$\begin{array}{lll} \text{To} & 3a + 4c - d + 2b & 2aa + 3b \\ \text{Add} & 7d + m - 2b + 2a & 7c - 7aa \\ \hline \text{Sum} & 5a + 4c + 6d + m & 3b + 7c - 5aa \end{array}$$

$$\begin{array}{ll} \text{To} & 7aa + 3ab + 2cc - 3d \\ \text{Add} & 7a - ab + aa + 7d \\ \hline \text{Sum} & 8aa + 2ab + 2cc + 4d + 7a \end{array}$$

$$\begin{array}{ll} \text{To} & 5cca + 2aab + 357c - 18aa - 27bc \\ \text{Add} & 2ca - 7aa + 3aab + 29c + abc - 18bc \\ \hline \text{Sum} & 5cca + 5aab + 386c - 25aa - 45bc + 2ca + abc \end{array}$$

SUBTRACTION

JOINS together the two proposed *Quantities*, changing all the Signs of the *Subducend*.

Hence, if the Signs be different, *Subtraction* will be performed by *Addition*, keeping the Sign of the *upper Quantity*.

In

In *Simple Quantities* of the same Kind.

From	$5a$	$2bc$	$4acd$	$3c$
Take	$2a$	bc	$4acd$	$-3c$
Rem.	$3a$	bc	0	$6c$

In *Simple Quantities* of a different Kind.

From	a	$3d$	c
Take	b	$2c$	b
Rem.	$a - b$	$3d - 2c$	$c - b$

From	dm	$4bc$	$-7aab$
Take	$2bd$	4	$-2ac$
Rem.	$dm - 2bd$	$4bc - 4$	$2ac - 7aab$

In *Compound Quantities* of the same Kind.

From	$4a + 3b$	$6c - 5b$	$5d + 12$
Take	$2a + 2b$	$4c - 3b$	$6d - 5$
Rem.	$2a + b$	$2c - 2b$	$17 - d$

From	$3c + 2a - b$	$ab - 4cd$
Take	$c + 3a - 2b$	$2ab - 5cd$
Rem.	$2c - a + b$	$cd - ab$

From	$3c + 2a - d$	$4a - 2c$
Take	$2c + 3a + d$	$2a - 6c$
Rem.	$c - a - 2d$	$2a + 4c$

From	$6a + 9b - 3c + 4d$	$4a + 3b$
Take	$7a + 2b - 3c + 8d$	$2a - 2b$
Rem.	$7b - a - 4d$	$2a + 5b$

From $2b - 2c + d$ $5bc - bb$
Take $b + 4c - d$ $3bb - 3bc$

Rem. $b - 6c + 2d$ $8bc - 4bb$

From $6bb + 3aa - 3c + 9b + 8a$
Take $4bb - 4aa - 6c - 5b + 3a$

Rem. $2bb + 7aa + 3c + 14b + 5a$

In *Compound Quantities* of a different Kind.

From $aa - bb$ $5b - 2a$
Take $ac - ab$ $3c + d$

Rem. $aa - bb - ac + ab$ $5b - 2a - 3c - d$

From $bc - dd$
Take $ad + bd - 2cd$

Rem. $bc - dd - ad - bd + 2cd$

In *Compound Quantities* of a mix'd Kind.

From $ccc + bbd - aac - eee$
Take $2bbd - 2ccc + eee$

Rem. $3ccc - bbd - aac - 2eee$

From $7abc + 2aa - 3aac$
Take $4ab - 7abc + 2aac$

Rem. $14abc + 2aa - 5aac - 4ab$

From $24aaa + 2bcd - 33ac + 49$
Take $13bcd + 27ac - 72 + abcd$

Rem. $24aaa - 11bcd - 60ac + 121 - abcd$

MUL-

MULTIPLICATION

JOINS together the Letters of the *Multiplicand*, and *Multiplier*, without any Sign between them.

Like Signs, whether + or —, make in the *Product* +, and different Signs —.

Multiply	a	a	aa	d
by	b	a	a	b
Product	ab	aa	aaa	db

Multiply	$4a$	$3bd$	ccc
by	$2b$	$2ab$	$5dd$
Product	$8ab$	$6abbd$	$5cccdd$

Multiply	$5cd$	$2ac$	c
by	$3ab$	10	12
Product	$15abcd$	$20ac$	$12c$

Multiply	$6bbbb$	$4abb$
by	$3bb$	$4ca$
Product	$18bbbbbb$	$16aabbc$

Multiply	$a + b$	$b - a$
by	c	$2d$
Product	$ca + cb$	$2db - 2da$

Multiply	$a + 2b - 3c + d$
by	$3e$
Product	$3ea + 6eb - 3ce + 3ed$

Multiply	$6b - 2a - c - 4b$
by	$2ab$
Product	$12abb - 4aab - 2abc - 8abb$

Multiply $c + d$
by $a + b$

Product $ac + ad + bc + db$

Multiply $b - a$
by $c - d$

Product $bc - ca - db + ad$

Multiply $a + b$
by $a + b$

$aa + ab$
$ab + bb$

Product $aa + 2ab + bb$

Multiply $a - b$
by $a - b$

$aa - ab$
$- ab + bb$

Product $aa - 2ab + bb$

Multiply $b + c$
by $b - c$

$bb + bc$
$- bc - cc$

Product $bb - cc$

Multiply $b + c - 2d$
by $b + c - 2d$

$bb + bc - 2bd$
$bc + cc - 2cd$
$- 2bd - 2dc + 4dd$

Product $bb + 2bc - 4bd + cc - 4cd + 4dd$

Multiply $6a - d - 2$
by $a + 2d$

$6aa - ad - 2a$
$12ad - 2dd - 4d$

Product $6aa + 11ad - 2a - 2dd - 4d$

Multiply $3bb - 2aa + 5$
by $9a + 4b - 1$

$27abb - 18aaa + 45a$
$12bbb - 8aab + 20b$
$-3bb + 2aa - 5$

Product $27abb - 18aaa - 45a + 12bbb - 8aab + 20b - 3bb + 2aa - 5.$

Multiply $a + b - c$
by $d + e$

Product $ad + bd - cd + ae + eb - ec$

DIVISION

RESolves the *Dividend* into the *Divisor* and *Quotient*; or, as it were, extracts the *Divisor* from the *Dividend*, and takes the *Residue* for the *Quotient*.

Like Signs make in the *Quotient* +, and different Signs —.

$a)aa(a$
aa
0

$c)bc(b$
bc
0

$2b)2abc(ac$
$2abc$
0

$3c)9cd(3d$
$9cd$
0

$b)3b(3$
$3b$
0

$2bb)4aabb(2aa$
$4aabb$
0

$2ccbbb)6cccbbbb(3cb$
$6cccbbbb$
0

$3abb)3aabbb(ab$
$3aabbb$
0

$9)18cd(2cd$
$18cd$
0

$5aab)40aabbc(8bc$
$40aabbc$
0

$$4bd)\,12bbccdddd\,(3bccddd$$
$$12bbccdddd$$
$$0$$

$$4aac)\,12aaaaccccddd\,(3aacccddd$$
$$12aaaaccccddd$$
$$0$$

$$b)\,ab+bc\,(a+c \qquad\qquad c)\,bc-cd\,(b-d$$
$$ab+bc \qquad\qquad bc-cd$$
$$0 \qquad\qquad 0$$

$$b+c)\,ab+ac+db+dc\,(a+d \qquad\qquad d+1)\,dd+d\,(d$$
$$ab+ac+db+dc \qquad\qquad dd+d$$
$$0 \qquad\qquad 0$$

$$d-c)\,bd-bc-ad+ac\,(b-a \qquad\qquad 2a-1)\,2aaa-aa\,(aa$$
$$bd-bc-ad+ac \qquad\qquad 2aaa-aa$$
$$0 \qquad\qquad 0$$

$$2aa+4ac)\,6aab+12abc-10aacccc-20acccccc\,(3b-5cccc$$
$$6aab+12abc-10aacccc-20acccccc$$
$$0$$

$$a+b)\,aa-bb\,(a-b \qquad\qquad a-b)\,aa-bb\,(a+b$$
$$aa+ab \qquad\qquad aa-ab$$
$$-ab-bb \qquad\qquad ab-bb$$
$$-ab-bb \qquad\qquad ab-bb$$
$$0 \qquad\qquad 0$$

$$b-a)\,bbb-3bba+3baa-aaa\,(bb-2ab+aa$$
$$bbb-bba \qquad\qquad \times\, b-a$$
$$-2bba+3baa \qquad\qquad bbb-2abb+aab$$
$$-2bba+2baa \qquad\qquad -abb+2aab-aaa$$
$$baa-aaa \qquad\qquad bbb-3abb+3aab-aaa$$
$$baa-aaa \qquad\qquad 0$$
$$0$$

$c+d$

$$
\begin{array}{l}
c+d)\,ccc+ddd\,(cc-cd+dd \\
\quad\;\; ccc+ccd \\
\hline
\quad\; -ccd+ddd \\
\quad\; -ccd-cdd \\
\hline
\quad\;\;\; ddd+cdd \\
\quad\;\;\; ddd+cdd \\
\hline
\qquad\quad 0
\end{array}
\qquad
\begin{array}{l}
\quad\;\; \times c+d \\
\hline
ccc-ccd+cdd \\
ccd-cdd+ddd \\
\hline
ccc+ddd \\
\hline
\qquad 0
\end{array}
$$

Note: If *Division* cannot be made after the preceeding Manner, then by placing the *Divisor* under the *Dividend* there will be a *Fraction*, so as to include the *Quotient*.

$$b)ac(\frac{ac}{b} \qquad d)c(\frac{c}{d} \qquad d)a+b(\frac{a+b}{d}$$

PROPORTION,

FROM two or three given Terms rightly disposed, by the Help of *Multiplication* and *Division*, produces a *third* or *fourth* Proportional required. Thus,

Multiply the *second* Number by itself, and divide the *Product* by the *first*, it gives the *third* Proportional.

Multiply the *second* Number by the *third*, and divide the *Product* by the *first* Number, it gives the *fourth* Proportional.

As $a : b :: b : \frac{bb}{a}$ the third Proportional.

As $a : 2a :: 2a : \frac{4aa}{a}$ that is, $4a$, the third Proportional.

As

As $b : ab :: ab : \frac{aabb}{b}$ that is, aab, the third Proportional

As $2c : d :: d : \frac{dd}{2c}$ the third Proportional.

As $a : a+b :: a+b$

$$\begin{array}{l} a+b \\ \hline aa+ab \\ ab+bb \\ \hline \frac{aa+2ab+bb}{a} \end{array}$$ the third Proportional.

As $a : b :: c : \frac{bc}{a}$ the fourth Proportional.

As $3a : b :: 3b : \frac{3bb}{3a}$ that is, $\frac{bb}{a}$ the fourth Proportional.

As $a : c :: 2ab : \frac{2abc}{a}$ that is, $2bc$, the fourth Proportional.

As $2b : 3a :: 4bd : \frac{12abd}{2b}$ that is, $6ad$, the fourth Proportional.

As $d : 5b :: a : \frac{5ba}{d}$ the fourth Proportional.

As $10aa : 7c :: 10dd : \frac{70ddc}{10aa}$ that is, $\frac{7ddc}{aa}$ the fourth Proportional.

As $a : a+b :: a-b$

$$\begin{array}{l} a-b \\ \hline aa+ab \\ -ab-bb \\ \hline \frac{aa-bb}{a} \end{array}$$ the fourth Proportional.

As

As $b : b + c :: 2b - c$

$$\begin{array}{l} 2b - c \\ \hline 2bb + 2bc \\ - bc - cc \\ \hline \end{array}$$

$\dfrac{2bb + bc - cc}{b}$ the fourth Proportional.

As $a + 2b : a :: 2a - b : \dfrac{2aa - ab}{a + 2b}$ the 4th Proportional.

As $3b - 3a : 2a + c :: 3d : \dfrac{6ad + 3cd}{3b - a}$ the fourth Proportional.

As $2d + c : 2d + b :: 2d - c$

$$\begin{array}{l} 2d - c \\ \hline 4dd + 2db \\ - 2dc - bc \\ \hline \end{array}$$

$\dfrac{4dd + 2db - 2dc - bc}{2d + c}$ the fourth Proportional.

REDUCTION *of* EQUATIONS,

IS the ordering of the Terms of an *Equation*, so that the given Quantities may possess one Side, and the required, the other.

Note, When *Quantities* are carried from one Side of an *Equation* to another, it is done by *Addition*, giving them the contrary Signs.

To find the *Value* of x in the following Equations.

Examples.

1. Let $a - b + x = b - x$.
Add $+x \qquad +x$.

Then $a - b + 2x = b$. By adding $+x$ to each
Add $-a + b \qquad -a + b$. Side of the Equat.

Then $2x = 2b - a$. By adding $-a + b$ to both Sides.

$\therefore x = \frac{2b - a}{2}$ By dividing each Side of the Equation by 2; for if $2x$ be equal to $2b - a$, then x must be equal to $\frac{1}{2}\, 2b - a$.

---

2. Let $x - a = b + c$. This Example is plain
Add $+a \qquad +a$. from the aforegoing.

Then $x = b + c + a$.

---

3. Let $x + a = b + c$. This Example needs
Add $-a \qquad -a$. no Explanation.

Then $x = b + c - a$.

---

4. Let $x + a - b = 2x + b$. This Example
Add $-x \qquad -x$ also needs no Explanation.

Then $a - b = x + b$
Add $-b \qquad -b$

Then $a - 2b = x$

---

5. Let $\frac{x}{a} = b$. For if $\frac{x}{a} = b$, then consequently b multiplied by a must be equal to x.

Then $x = ab$.

6. Let

6. Let $\frac{x}{3b} = a - c$.

Then $x = 3ba - 3bc$; as is plain from the Argument in the preceeding.

---

7. Let $\frac{5x + b - da}{2} = 156$.

Then $5x + b - da = 312$, as in former Example.
Add $\quad - b \quad\quad - b$.

Then $5x - da = 312 - b$.
Add $\quad + da \quad\quad + da$.

Then $5x = 312 - b + da$.

$\therefore x = \frac{312 - b + da}{5}$ on the same Argument used in Example 1.

---

8. Let $xx = 6x$
Then $x = 6$.

Each Side of the Equation divided by x.

---

9. Let $3xx = 9x$.
Then $xx = 3x$, as aforegoing.
$\therefore x = 3$, as is plain.

---

10. Let $xx + ax = bx + cx$
Then $x + a = b + c$,
Add $\quad - a \quad\quad - a$
Then $x = b + c - a$

rejecting x from each Quantity, is dividing the whole by x.

---

11. Let $xx = abc$.
Then $x = \sqrt[2]{abc}$

For if xx be the Square of x, then the Square Root of abc, must be equal to x.

12. Let $xxx = 7abcd$. Then $x = \sqrt[3]{7abcd}$

If xxx be the Cube of x, then the Cube Root of $7abcd$, must be equal to x.

---

13. $$\begin{array}{ll}
\text{Let} & ax + ab + bc = cx + 2d - a \\
\text{Add} & -cx \qquad\qquad -cx \\
\text{Then} & ax - cx + ab + bc = 2d - a \\
\text{Add} & - - - - -ab \qquad -ab \\
\text{Then} & ax - cx + bc = 2d - a - ab \\
\text{Add} & - - - -bc \qquad -bc \\
\text{Then} & ax - cx = 2d - a - ab - bc \\
\therefore & x = \dfrac{2d - a - ab - bc}{a - c}
\end{array}$$

The Steps in the Process of this *Example* might have been in a less Number, by carrying *more* Quantities than *one* at a time. But as I have done here, I shall follow the like Method through the following *Examples*, and do hope the *Reader* will not deem it superfluous; my End being their Instruction, and an Endeavour to render this *Treatise* as sufficiently explicit as I could.

Note: I shall omit the *Additions* of the *Quantities* to each Side of the *Equation*, as not necessary, hoping the *Learner* will plainly see, by what has already been done, the *Process* in every Step, till it comes to a *Conclusion*, in finding the Value of the *unknown Quantity*, as may be required.

SIMPLE

SIMPLE EQUATIONS.

1. TO find a *Number*, which being *multiplied* by 3, and from the *Product* 5 *subtracted*; then the *Remainder divided* by 2, and to the *Quotient* if the *Number* sought be *added*, the *Sum* shall be 40.

Numerically.

x, the Number sought.

$$\begin{array}{l} x \\ \underline{3} \\ \dfrac{3x-5}{2}+x=40 \end{array}$$

Then $\dfrac{3x-5+2x}{2}=40$

$\therefore 3x-5+2x=80$

$\therefore 5x-5=80$

$\therefore 5x=85$

$\therefore x=\dfrac{85}{5}=17$

$$\begin{array}{r} 17 \\ \underline{3} \\ 51 \\ \underline{5} \\ 2)\overline{46}(\\ 23 \\ \underline{17} \\ 40 \end{array}$$

Literally.

Let $3=a$
$5=b$
$2=c$
$40=d$

$$\begin{array}{l} x \\ \underline{a} \\ \dfrac{ax-b}{c}+x=d \end{array}$$

Then $\dfrac{ax-b+cx}{c}=d$

$$\begin{array}{r} 3=a \\ \underline{2=c} \\ 5 \end{array}$$

$$\begin{array}{r} d=40 \\ \underline{c=2} \\ cd=80 \\ b=\underline{5} \\ a+c=5)\overline{85} \\ 17 \end{array}$$

$\therefore ax-b+cx=cd$

$\therefore ax+cx=cd+b$

$\therefore x=\dfrac{cd+b}{a+c}=17$

2. To find a *Number*, which being *multiplied* by 12, to the *Product add* 48, it shall produce the same, as if the *Number* sought, was *multiplied* by 18.

Numerically.

x, the Number sought.
12

$$12x + 48 = 18x$$
$$\therefore 48 = 6x$$
$$\therefore x = \frac{48}{6} = 8$$

8
12
96 | 18
48 | 8
144 = 144

Literally.

Let $12 = a$ | $48 = b$ | $18 = c$

x, the Number sought.
a

$$ax + b = cx$$
$$\therefore b = cx - ax$$
$$\therefore x = \frac{b}{c - a} = 8$$

$18 = c$
$12 = a$
$c - a = 6)48(8$
0

3. To find a *Number*, to which if 11 be *added*, and from the same *Number* 7 be *subtracted*; the Sum of the *Addition* shall be double to the Remainder of the *Subtraction*.

Numerically.

x, the Number sought.

x | x
11 | 7
$x + 11$ | $x - 7$
| 2
| $2x - 14$

Then $x + 11 = 2x - 14$
$\therefore 11 = x - 14$
$\therefore 11 + 14 = x = 25$

25 | 25
11 | 7
36 | 18

Literally.

Literally.

Let $11 = a$ $\quad \frac{x}{a}$ $\quad \frac{x}{b}$ $\quad 11 = a$

$7 = b$ $\quad \overline{x + a}$ $\quad \overline{x - b}$ $\quad \frac{14 = 2b}{25}$

$\quad\quad\quad\quad \frac{2}{2x - 2b}$

Then $x + a = 2x - 2b$

$\therefore a = x - 2b$

$\therefore x = a + 2b = 25$

4. To find a *Number*, to which, if the *double*, *treble*, or *Quadruple* of it be *added*, it ſhall produce its *Square*.

x, the Number ſought.

$$\frac{2x}{3x = xx} \quad \frac{\frac{x}{3x}}{4x = xx} \quad \frac{\frac{x}{4x}}{5x = xx}$$

$$\therefore x = 3 \quad \therefore x = 4 \quad \therefore x = 5$$

$$\frac{6}{9} \quad \frac{12}{16} \quad \frac{20}{25}$$

5. To find a *Number*, to which if you *add* itſelf, and *multiply* the Sum by the *ſame*, then if from the *Product* you *ſubtract* the *ſame Number*, and *divide* the *Remainder* by the *ſame*, the *Quotient* ſhall be 13.

Numerically.

x, the Number required.

$$\frac{x}{2x} \quad \text{Then } \frac{2xx - x}{x} = 13 \quad \frac{\frac{7}{7}}{14}$$

$$\frac{x}{2xx - x} \quad \therefore 2xx - x = 13x \quad \frac{7}{98}$$

$$\therefore 2x - 1 = 13$$

$$\therefore 2x = 14 \quad \frac{7}{7)91}$$

$$\overline{x} \quad \therefore x = \frac{14}{2} = 7 \quad 13$$

Literally.

Literally.

Let $13 = a$

$$\begin{array}{r} x \\ x \\ \hline 2x \\ x \\ \hline \end{array}$$

Then $\dfrac{2xx - x}{x} = a$

$\therefore\ 2xx - x = ax$

$\therefore\ 2x - 1 = a$

$\therefore\ 2x = a + 1$

$\therefore\ x = \dfrac{a+1}{2} = 7$

6. To *divide* the *Number* 16, into 2 Parts; so that the *Square* of the *greater*, may exceed the *Square* of the *lesser* by 32.

Numerically.

$$\begin{array}{r} \ulcorner x \\ x \\ \hline xx \end{array} \qquad \begin{array}{l} 16 - x \\ 16 - x \\ \hline 256 - 16x \\ \quad 16x + xx \\ \hline 256 - 32x + xx \end{array}$$

Then $256 - 32x + xx + 32 = xx$

$\therefore\ 256 - 32x + 32 = 0$

$\therefore\ 288 = 32x = 0$

$\therefore\ 288 = 32x$

$\therefore\ x = \dfrac{288}{32} = 9$

$$\begin{array}{r} \ulcorner 9 \\ 9 \\ \hline 81 \end{array} \qquad \begin{array}{r} \urcorner 7 \\ 7 \\ \hline 49 \\ 32 \\ \hline 81 \end{array}$$

Literally.

Literally.

Let $16 = a$ [x] $a - x$
$32 = b$ $\quad x \quad\quad a - x$

$$\begin{array}{r} x \\ x \\ \hline xx \end{array} \qquad \begin{array}{r} a - x \\ a - x \\ \hline aa - ax \\ - ax + xx \\ \hline aa - 2ax + xx \end{array}$$

Then $aa - 2ax + xx + b = xx$
∴ $aa - 2ax + b = 0$
∴ $aa + b = 2ax$
∴ $x = \dfrac{aa + b}{2a} =$

$$\begin{array}{r} a = 16 \\ a = 16 \\ \hline 96 \\ 16 \\ \hline aa = 256 \\ b = 32 \\ \hline 2a = 32)288(9 \\ 288 \\ \hline \end{array}$$

7. To *divide* the *Number* 36 into Two Parts; so that if 12 be *added* to the *greater*, and 6 to the *lesser*, the *Sum* of the former may be *double* to the *Sum* of the latter.

Numerically.

$$\begin{array}{rr} [\,x\,] & 36 - x \\ 12 & 6 \\ \hline x + 12 & 42 - x \\ & 2 \\ \hline & 84 - 2x \end{array}$$

Then $x + 12 = 84 - 2x$
∴ $3x + 12 = 84$
∴ $3x = 72$
∴ $x = \dfrac{72}{3} = 24$

$$\begin{array}{rr} [\,24\,] & 12 \\ 12 & 6 \\ \hline 36 & 18 \end{array}$$

Literally.

Let $36=a$ $\quad [x] \quad a-x$

$12=b$ $\quad b \quad c$

$6=c$ $\quad \overline{x+b} \quad \overline{a-x+c}$

2

Then $x+b=2a-2x+2c$ $\qquad \overline{2a-2x+2c}$

$\therefore 3x+b=2a+2c$

$\therefore 3x=2a+2c-b$ $\qquad 2a=72$

$\therefore x=\dfrac{2a+2c-b}{3}$ $\qquad 2c=12$

$$\begin{array}{r} 2a+2c=84 \\ b=12 \\ \hline 3)72 \\ \hline 24 \end{array}$$

8. A *General*, diſpoſing his Army into a *Square* Battle, finds he has 284 *Soldiers*, over and above; but increaſing each Side by *one Soldier*, he wants 25 *Soldiers* to fill up the *Square*. How many *Soldiers* had he?

Numerically.

x, the Number of Soldiers in a Side.

$$\begin{array}{r} x \\ \hline xx+284 \end{array}$$ the whole Army.

$$\begin{array}{r} x+1 \\ x+1 \\ \hline xx+x \\ x+1 \\ \hline xx+2x+1 \end{array}$$

Then $xx+2x+1-25=xx+284$

$\therefore 2x+1-25=284$

$\therefore 2x-24=284$

$\therefore 2x=308$

$\therefore x=\dfrac{308}{2}=154$

$$\begin{array}{r} 154 \\ 154 \\ \hline 616 \\ 770 \\ 154 \\ \hline 23716 \\ 284 \\ \hline \end{array}$$

Whole Army 24000

$$\begin{array}{r} 155 \\ 155 \\ \hline 775 \\ 775 \\ 155 \\ \hline 24025 \\ 25 \\ \hline 24000 \end{array}$$

Literally.

Let $284 = a$ x $x + b$

$1 = b$ x $x + b$

$25 = c$ $\overline{xx + a}$ $\overline{xx + bx}$

$bx + bb$

$\overline{xx + 2bx + bb}$

Then $xx + a = xx + 2bx + bb - c$ $25 = c$

$\therefore a = 2bx + bb - c$ $\underline{284 = a}$

$\therefore 2bx - c = a - bb$ $309 = c + a$

$\therefore 2bx = c + a - bb$ $\underline{1 = b}$

$\therefore x = \dfrac{c + a - bb}{2b} = 154$ $2)308 = c + a - 2b$

154

9. A *Captain* sends out $\frac{1}{3}$ of his *Soldiers* + 10, there remains with him $\frac{1}{2}$ + 15. How many *Soldiers* had he?

Numerically.

x, the Number of Soldiers he had.

$\dfrac{x}{3} + 10$, that is, $\dfrac{x + 30}{3}$ Soldiers sent out.

$\dfrac{x}{2} + 15$, that is, $\dfrac{x + 30}{2}$ Soldiers remaining.

Then $\dfrac{x + 30}{3} + \dfrac{x + 30}{2} = x$ $3)150$ $2)150$

$\therefore \dfrac{2x + 60 + 3x + 90}{6} = x$ 50, $\underline{10}$, 60 75, $\underline{15}$, 90

$\therefore 2x + 60 + 3x + 90 = 6x$ $\underline{90}$

$\therefore 5x + 150 = 6x$ 150

$\therefore x = 150$

 Literally.

Literally.

Let $10 = a$ $\quad \frac{x}{3} + a$ is $\frac{x + 3a}{3}$ fent out.
$15 = b$ $\quad \frac{x}{2} + b$ is $\frac{x + 2b}{2}$ remained.

Then $\frac{x + 3a}{3} + \frac{x + 2b}{2} = x$

$\therefore \frac{2x + 6a + 3x + 6b}{6} = x$ $\qquad 6a = 60$, $6b = 90$, 150

$\therefore 2x + 6a + 3x + 6b = 6x$
$\therefore 5x + 6a + 6b = 6x$
$\therefore x = 6a + 6b = 150$

10. There is an *Army*, to which if you add $\frac{1}{2}$ $\frac{2}{3}$ $\frac{3}{4}$ of itfelf, and from the *Total* take away 5000, the *Remainder* fhall be 100000. What was the *Number* of the *Army?*

Numerically.

x, the Army.

$$\frac{\frac{x}{2} + \frac{2x}{3} + \frac{3x}{4}}{24} \quad 12x + 16x + 18x \quad 46x$$

Then $x + \frac{46x}{24} - 5000 = 100000$

$\therefore 24x + 46x - 120000 = 2400000$
$\therefore 70x - 120000 = 2400000$
$\therefore 70x = 2520000$
$\therefore x = \frac{2520000}{70} = 36000$

36000
18000
24000
27000
105000
5000
100000

Literally.

Let $5000 = a$
$100000 = b$

$$\begin{array}{r} 24 \\ \underline{5000} = a \\ 120000 = 24a \end{array}$$

$$\begin{array}{r} 100000 = b \\ \underline{24} \\ 2400000 = 24b \\ \underline{120000} \\ 7|0)252000(0 = 24a + 24b \\ 36000 \end{array}$$

Then $x + \frac{46x}{24} - a = b$

$\therefore 24x + 46x - 24a = 24b$

$\therefore 70x - 24a = 24b$

$\therefore 70x = 24a + 24b$

$\therefore x = \frac{24a + 24b}{70} = 36000$

11. To find *two* Numbers in the *Proportion* of 2 to 3, whose *Product*, when *multiplied*, shall be 54.

Numerically.

x, one Number. As $2 : 3 :: x : \frac{3x}{2}$ the other Number.

$$\frac{3xx}{\frac{\frac{3x}{2} \times \frac{x}{1}}{2}}$$

As $2 : 3 :: 6 : 9$

$$\begin{array}{r} \underline{9} \\ 54 \end{array}$$

Then $\frac{3xx}{2} = 54$

$\therefore 3xx = 108$

$\therefore xx = \frac{108}{3} = 36$

$\therefore x = \sqrt[2]{36} = 6$

Literally.

Let $2 = a$
$3 = b$
$54 = c$

As $a : b :: x : \frac{bxx}{\frac{\frac{bx}{a} \times \frac{x}{1}}{a}}$

Then

Then $\frac{bxx}{a}=c$ $\quad 54=c$

$\quad 2=a$

$\therefore bxx=ac \quad b=3)108=2\dot{t}$

$\therefore xx=\frac{ac}{b} \quad \sqrt[2]{36}(6$

$\quad 36$

$\quad 0$

$\therefore x=\sqrt[2]{\frac{ac}{b}}=6$

12. To find *two* Numbers, in the *Ratio* of 4 to 5, and the Sum of their *Squares* to be 2624.

Numerically.

x, one Number. As $4:5::x:\frac{5x}{4}$ the other Number.

$\frac{5x}{4}\times\frac{5x}{4}=\frac{25xx}{16}$

Then $\frac{25xx}{16}+xx=2624$

$\therefore 25xx+16xx=41984$

$\therefore 41xx=41984$

$\therefore xx=\frac{41984}{41}=1024$

$\sqrt[2]{1024}=32$

As $4:5::32:40$

41)41984(1024
98
164
0

$\sqrt[2]{1024}(32$
62)124
0

32
5
4)160
40

40
40
1600
1024
2624

Literally.

Literally.

Let $4 = a$
$5 = b$
$2624 = c$

As $a : b : x :: \dfrac{\frac{bx}{a} \times \frac{bx}{a}}{} = \dfrac{bbxx}{aa}$

Then $\dfrac{bbxx}{aa} + xx = c$

$\therefore bbxx + aaxx = aac]$

$\therefore xx = \dfrac{aac}{bb+aa}$

$25 = bb$
$16 = aa$
$41 = bb + aa$

$\therefore x = \sqrt[2]{\dfrac{aac}{bb+aa}} = 32$

$$\begin{array}{r} 2624 = c \\ 16 = aa \\ \hline 15744 \\ 2624 \\ \hline 41|41984|1024 \\ 98 \\ 82 \\ \hline 164 \\ \hline 0 \end{array} \qquad \begin{array}{l} \sqrt[2]{1024}(32 \\ 62)124 \\ \hline \quad 0 \end{array}$$

13. To find the *Side* of a *Square*, whose *Area* is to the *Sum* of the Sides, as 45 is to 12.

Numerically.

x, the Side of the Square.
xx, the Area.
$4x$, the Sum of the Sides.

As $xx : 4x :: 45 : 12$

$$\begin{array}{l} \quad 12 \qquad 4x \\ \hline \text{Then } 12xx = 180x \\ \therefore 12x = 180 \\ \therefore x = \dfrac{180}{12} = 15 \end{array}$$

$$\begin{array}{r} 15 \\ 15 \\ \hline 75 \\ 15 \\ \hline 225 \end{array} \qquad \begin{array}{r} 15 \\ 4 \\ \hline 60 \end{array}$$

As $225 : 60 :: 45 : 12$

$$\begin{array}{r} 225 \\ 12 \\ \hline 2700 \end{array} \qquad \begin{array}{r} 45 \\ 60 \\ \hline 2700 \end{array}$$

Literally.

Literally.

Let $45 = a$
$12 = b$

$45 = a$
4
$b = 12)\overline{180} = 4a$
15

As $xx : 4x :: a : b$
$b \quad 4x$

Then $bxx = 4ax$
$\therefore bx = 4a$
$\therefore x = \frac{4a}{b} = 15$

14. To find the *Side* of a *Cube*, whoſe *Superficies* is to the *Solidity*, as 6 to 11.

Numerically.

x, the Side of the Cube.
xxx, the Solidity.
$6xx$, the Superficies.

As $6 : 11 :: 6xx : xxx$
$xxx \quad 11$

Then $6xxx = 66xx$
$\therefore 6x = 66$
$\therefore x = \frac{66}{6} = 11$

$11 \times 11 = 121$, $121 \times 6 = 726$
$11 \times 11 = 121$, $121 \times 11 = 1331$

As $6 : 11 :: 726 : 1331$
$11 \quad 6$
$7986 = 7986$

Literally.

Let $6 = a$
$11 = b$

$11 = b$
6
$a = 6)\overline{66} = 6b$
11

As $a : b :: 6xx : xxx$
$b \quad a$

Then $6bxx = axxx$
$\therefore 6b = ax$
$\therefore x = \frac{6b}{a} = 11$

15 A

15. A certain Man hires a *Labourer* on this Condition, that for every Day he worked, he should have 3 *Shillings*; but for every Day he worked not, he should pay 2 *Shillings*: When 390 *Days* were past, neither of them were indebted to each other. I demand how many *Days* he worked, and how many *Days* he worked not.

Numerically.

x, the Days that he worked.

$390 - x$, the Days that he worked not.

$$\begin{array}{l} 390 - x \\ \quad 2 \\ \hline 780 - 2x = 3x \\ \therefore 780 = 5x \\ \therefore x = \dfrac{780}{5} = 156 \end{array} \qquad \begin{array}{r} 156 \\ 3 \\ \hline 468 \end{array} \qquad \begin{array}{r} 390 \\ 156 \\ \hline 234 \\ 2 \\ \hline 468 \end{array}$$

Literally.

$$\begin{array}{l} \text{Let } 2 = a \\ \quad\; 3 = c \\ 390 = b \end{array} \qquad \begin{array}{l} b - x \\ \quad a \\ \hline \text{Then } ab - ax = cx \\ \therefore cx + ax = ab \\ \therefore x = \dfrac{ab}{c+a} = 156 \end{array} \qquad \begin{array}{r} b = 390 \\ a = 2 \\ \hline 5)780 = ab \\ \hline 156 \end{array}$$

16. A certain Gentleman hires a *Servant*, and promises him 24 *l.* *yearly* Wages, and a *Cloak*. At 8 *Months* End, the *Servant* obtains Leave to go away, and receives for his Wages the *Cloak*, with 13 *l.* I demand the Value of the *Cloak*.

Numerically.

x, the Value of the Cloak.

$$\text{As } 12 : x + 24 :: 8 : x + 13$$

$$\begin{array}{rcl} 8 & & 12 \\ \hline \text{Then } 8x + 192 & = & 12x + 156 \end{array}$$

$\therefore 192 = 4x + 156$

$\therefore 4x = 36$

$\therefore x = \frac{36}{4} = 9$

As $12 : 33 :: 8 : 22$

$$\begin{array}{ccc} 33 & & 22 \\ 8 & & 12 \\ \hline 264 & = & 264 \end{array}$$

Literally.

Let $24 = a$
$8 = b$
$12 = c$
$13 = d$

As $c : a + x :: b : d + x$

$$\begin{array}{ccc} a+x & & d+x \\ b & & c \\ \hline ba + bx & = & cd + cx \end{array}$$

Then $ba + bx = cd + cx$

$\therefore ba = cx - bx + cd$

$\therefore cx - bx = ba - cd$

$\therefore x = \frac{ba - cd}{c - b} = 9$

$$\begin{array}{ll} a = 24 & 13 = d \\ b = 8 & 12 = c \\ \hline ba = 192 & 156 = cd \end{array}$$

$cd = 156$

$c - b = 4)36 = ba - cd$

$\quad 9$

17. A Perſon being aſked, How old he was? anſwered, If I *quadruple* $\frac{2}{3}$ of my Years, and *add* $\frac{1}{2}$ of them + 50, to the *Product*, the *Sum* will be ſo much *above* 100, as the *Number* of my Years is now *under* 100.

Numerically.

x, the Age of the Perſon.

$\frac{8x}{3} + \frac{x}{2} + 50$, is $\frac{16x + 3x + 300}{6}$

$$\frac{2x}{3} \times \frac{4}{1} = \frac{8x}{3}$$

Then $\frac{16x + 3x + 300}{6} - 100 = 100 - x$

$\therefore 16x$

$\therefore 16x + 3x + 300 - 600 = 600 - 6x$

$\therefore 19x - 300 = 600 - 6x$

$\therefore 25x - 300 = 600$

$\therefore 25x = 900$

$\therefore x = \dfrac{900}{25} = 36$

$$\begin{array}{r} 100 \\ -36 \\ \hline 64 \end{array}$$

$$\begin{array}{r} 26 \\ 2 \\ \hline 3)72 \\ \hline 24 \\ 4 \\ \hline 96 \\ 18 \\ 50 \\ \hline 164 \\ 100 \\ \hline 64 \end{array}$$

Literally.

Let $50 = a$ $\quad \dfrac{8x}{3} + \dfrac{x}{2} + a$ is $\dfrac{16x + 3x + 6a}{6}$

$100 = b$

Then $\dfrac{16x + 3x + 6a}{6} - b = b - x$

$$\begin{array}{r} 50 = a \\ 6 \\ \hline 300 = 6a \end{array} \qquad \begin{array}{r} 100 = b \\ 12 \\ \hline 1200 = 12b \\ 300 = 6a \end{array}$$

$\therefore 19x + 6a - 6b = 6b - 6x$

$\therefore 25x + 6a - 6b = 6b$

$\therefore 25x = 12b - 6a$

$\therefore x = \dfrac{12b - 6a}{25} = 36$

$$\begin{array}{r} 25)900(36 \\ 150 \\ \hline 0 \end{array}$$

18, One being asked, What a Clock it was? answered, The Day at this Time is 16 *Hours* long. If to $\frac{1}{2}$ the Hours past, be *added* $\frac{2}{3}$ of the Hours to come, you will have the *Hour*, from Sun-rising.

Numerically.

x, the Hours past.
$16 - x$, the Hours to come.

$$\begin{array}{c} 2 \\ \hline 32 - 2x \\ \hline 3 \end{array} \qquad \frac{x}{2} + \frac{32 - 2x}{3} \text{ is } \frac{3x + 64 - 4x}{6}$$

Then $\dfrac{3x + 64 - 4x}{6} = x$

 $\therefore 64$

$\therefore 64 - x = 6x$

$\therefore 64 = 7x$

$\therefore x = \frac{64}{7} = 9\frac{1}{7}$

$\frac{1}{2}$ of $\frac{64}{7}$ is $\frac{64}{14} = \frac{32}{7}$

$\frac{2}{3}$ of $\frac{48}{7}$ is $\frac{96}{21} = \frac{32}{7}$

$\frac{32}{7} + \frac{32}{7}$ is $\frac{64}{7} = 9\frac{1}{7}$

$$\begin{array}{r} 16 \\ 9\frac{1}{7} \\ \hline 6\frac{6}{7} \end{array}$$ is $4\frac{4}{7}$

Literally.

Let $16 = a$

$$\begin{array}{r} a - x \\ 2 \\ \hline 2a - 2x \\ \hline 3 \end{array}$$

$$\frac{\frac{x}{2} + \frac{2a - 2x}{3}}{6}$$ $3x + 4a - 4x$

Then $\frac{3x + 4a = 6x}{6} = x$

$\therefore 4a - x = 6x$

$\therefore 4a = 7x$

$\therefore x = \frac{4a}{7} = 9\frac{1}{7}$

$$\begin{array}{r} 16 = a \\ 4 \\ \hline 7)64 = 4a \\ \hline 9\frac{1}{7} \end{array}$$

19. From *Norimberg* to *Rome* is 140 *Miles*. A *Traveller* ſets out at the ſame Time from each of the ſaid Cities; the *one* goes 8 *Miles* a Day, and the *other* 6. In *how many* Days will they meet, and *how many* Miles will each of them have gone?

Numerically.

x, the Number of Days in which they meet.
$8x$, the Number of Miles one had gone.
$6x$, the Number of Miles the other had gone.

Then $8x + 6x = 140$

$\therefore 14x = 140$

$\therefore x = \frac{140}{14} = 10$

$$\begin{array}{r} 10 \\ 8 \\ \hline 80 \end{array} \qquad \begin{array}{r} 10 \\ 6 \\ \hline 60 \\ 80 \\ \hline 140 \end{array}$$

Literally.

Let $140 = a$ Then $bx + cx = a$

$8 = b$ $\therefore x = \frac{a}{b+c} = 10$

$6 = c$

$$\begin{array}{r} 14)140 \\ \hline 10 \end{array}$$

20. A certain *Messenger* goes 6 *Miles* every Day; 8 Days after, another follows him, and goes 10 *Miles* every Day. In *how many* Days will the *latter* overtake the *former*?

Numerically.

x, the Days in which the latter will overtake the former.

Then $6x + 48 = 10x$

$\therefore 48 = 4x$

$\therefore x = \frac{48}{4} = 12$

$$\begin{array}{r} 10 \\ 12 \\ \hline 120 \end{array} \qquad \begin{array}{r} 12 \\ 6 \\ \hline 72 \\ 48 \\ \hline 120 \end{array}$$

Literally.

Let $6 = a$ Then $ax + ab = cx$

$8 = b$ $\therefore ab = cx - ax$

$10 = c$ $\therefore x = \frac{ab}{c-a} = 12$

$$\begin{array}{r} 6 \\ 8 \\ \hline 4)48(12 \end{array}$$

21. One bought 3 Books, whose Prices were in *Proportion*, as 12, 5, and 1. If the Price of the *first* be *doubled*, of the *second trebled*, and of the *third quadrupled*, the *Sum* of those *Products* will as much *exceed* 10 *Crowns*, as the *Sum* of the Price of the *greatest* and *middlemost* is *under* 5 *Crowns*. How much did the said Books cost?

Numerically.

$12x$, the Price of the first Book.

$5x$, the Price of the second.

x, the Price of the third.

The first doubled is - - - $24x$
The second trebled is - - $15x$
The third quadrupled is - $4x$

$12x + 5x$ is $17x$ — $43x$

Then $43x - 10 = 5 - 17x$
$\therefore 60x - 10 = 5$
$\therefore 60x = 15$
$\therefore x = \frac{15}{4} = \frac{1}{4} = 1 : 3$ (s. d.)

s.	d.		£.	s.	d.
1 . 15 . 0		- -	1 : 10 : 0		
2 . 6 . 3		- -	0 : 18 : 9		
3 . 1 . 3		- -	0 : 5 : 0		
0 : 15 : 0			2 : 13 : 9		
0 : 6 : 3			2 : 10 : 0		
1 : 1 : 3			0 : 3 : 9		
1 : 5 : 0					
0 : 3 : 9					

Literally.

Let $12 = a$, $5 = b$, $1 = c$, $10 = d$, $5 = e$

Then $2ax + 3bx + 4cx - d = e - ax - bx$
$\therefore 3ax + 3bx + 4cx - d = e - bx$
$\therefore 3ax + 4bx + 4cx - d = e$
$\therefore 3ax + 4bx + 4cx = e + d$
$\therefore x = \frac{e + d}{3a + 4b + 4c} = \frac{1}{4}$

$d = 10$, $e = 5$, sum 15 $\qquad$ $36 = 3a$, $20 = 4b$, $4 = 4c$, sum 60 $\qquad$ $\frac{15}{60} = \frac{1}{4}$

22. To *divide* the *Number* 50 into 2 Parts; so that if the *greater* be *divided* by 7, and the *lesser multiplied* by 3, the *Sum* of the *Quotient* and *Product* may produce just 50.

Numerically.

$\ulcorner x \quad \urcorner\ 50 - x$

$$\frac{50 - x}{\quad}\times 3 = 150 - 3x$$

Then $\frac{x}{7} + 150 - 3x = 50$

$$\begin{array}{ll} \therefore x + 1050 - 21x = 350 & \sqsubset 35 \ \sqsupset \ 15 \\ \therefore 1050 - 20x = 350 & \qquad\qquad\quad 3 \\ \therefore 1050 = 20x + 350 & \qquad\qquad\quad \overline{45} \\ \therefore 20x = 700 & \qquad\qquad\quad 5 \\ \therefore x = \frac{700}{20} = 35 & \qquad\qquad\quad \overline{50} \end{array}$$

Literally.

Let $50 = a$ $\quad \sqsubset x \ \sqsupset \ a - x$
$7 = b$ $\quad\quad\quad\quad\quad\quad c$
$3 = c$ $\quad\quad\quad\quad\quad \overline{ca - cx}$

$$\begin{array}{lll} bc = 21 & a = 50 & \text{Then } \frac{x}{b} + ca - cx = a \\ \underline{a = 50} & \underline{b = 7} & \therefore x + bca - bxc = ba \\ bcx = 1050 & 350 = ba & \therefore x + bca = ba + bcx \\ ba = \underline{350} & & \therefore x + bc - aba = bcx \\ bc - 1 = 2|0)\underline{70|0} & & \therefore bca - ba = bcx - x \\ \quad 35 & & \therefore x = \frac{bca - ba}{bc - 1} = 35 \end{array}$$

23. To *divide* the Number 20 into 2 Parts; so that the *Square* of the *lesser*, *subtracted* from the *Square* of the *greater*, may leave just 20.

Numerically.

$$\begin{array}{ll} \sqsubset x \ \sqsupset & 20 - x \\ \quad x & 20 - x \\ \quad \overline{xx} & \overline{400 - 20x} \\ & \quad - 20x + xx \\ & \overline{400 - 40x + xx} \end{array}$$

Then

Then $xx - 400 + 40x - xx = 20$

$\because 40x - 400 = 20$

$\because 40x = 420$

$\because x = \dfrac{420}{40} = 10.5$

$$\begin{array}{rr}
\lceil 10.5 & \rceil 9.5 \\
10.5 & 9.5 \\
\hline
525 & 475 \\
1050 & 855 \\
\hline
110.25 & 90.25 \\
90.25 & \\
\hline
20.00 &
\end{array}$$

Literally.

Let $20 = a$

Then $xx - aa + 2ax - xx = a$

$\because 2ax - aa = a$

$\because 2ax = a + aa$

$\because x = \dfrac{a + aa}{2a} = 10.5$

$$\begin{array}{rl}
\lceil x & \rceil a - x \\
 & a - x \\
\hline
 & aa - ax \\
 & -ax + xx \\
\hline
 & aa - 2ax + xx
\end{array}$$

$$\begin{array}{l}
20 = a \\
20 \\
\hline
400 = aa \\
20 \\
\hline
2a = 40\,)420(\,10.5
\end{array}$$

24. If a Man gains 20 *Crowns* a Week, how much muſt he ſpend a Week, to have 500 *Crowns*, together with the Expence of 4 *Weeks*, at the Year's End.

Numerically.

x, Crowns ſpent in a Week.

$52x$, the Expence of a Year.

1560, the Gain of a Year.

$$\begin{array}{l}
56)1060(18\tfrac{13}{14} \\
\underline{\quad 500} \\
\quad\ 52
\end{array}$$

Then

Then $52x+4x+500=1560$
$\because 56x+500=1560$
$\because 56x=1060$
$\because x=\frac{1060}{56}=18\frac{13}{14}$

$$\begin{array}{r} 265 \\ 52 \\ \hline 530 \\ 1325 \\ \hline 13780 \end{array}$$

$$\frac{1060}{56}=\frac{265}{14}\times 52, \text{ is } \frac{13780}{14}.$$

$$\frac{265}{14}\times 4, \text{ is } \frac{1060}{14}$$

$$\frac{13780}{14}+\frac{1060}{14} \text{ is } \frac{14840}{14}=\frac{7420}{7}=1060$$

$$\begin{array}{r} 1060 \\ 500 \\ \hline 1560 \end{array}$$

Literally.

Let $30=a$
$500=b$
$4=c$
$52=d$

Then $dx+cx+b=ad$
$\because dx+cx=ad-b$
$\because x=\frac{ad-b}{d+c}=18\frac{13}{4}$

$$\begin{array}{r} 52=d \\ 30=a \\ \hline 1560=ad \\ 500=b \\ \hline \end{array}$$

$d+c=56)1060(18\frac{13}{14}$

25. A *Labourer*, after 40 *Weeks* in which he had been employed, laid up 28 *Crowns*, leſs the Pay of 3 *Weeks*, and finds he had expended 36 *Crowns*, more the Pay of 11 *Weeks*. What Pay did he receive *per Week?*

Numerically.

x, the Pay of a Week.
$40x$, the whole Pay.

Then $28-3x+36+11x=40x$ | 28

$\because 64+8x=40x$ | 6

$\because 64=32x$ | 40 | 22

$\because x=\frac{64}{32}=2$ | 2 | 36

80 | 22

80

Literally.

Let $40=a$ Then $b-cx+d+ex=ax$

$28=b$ $\because b+d=ax+cx-ex$

$3=c$ $\because x=\frac{b+d}{a+c-e}=2$

$36=d$

$11=e$

$40=a$ $28=b$

$3=c$ $36=d$

$43=a+c$ $32)64(2$

$11=e$ 0

$32=a+c-e$

26. Two Companions having got a Parcel of *Guineas*; says *A* to *B*, if you will give me *one* of your *Guineas*, I ſhall have as *many* as you. Nay, replies *B*, if you will give me *one* of yours, I ſhall have *twice as many* as you. How many *Guineas* had each of them?

A had x Guineas, and *B* y Guineas.

Then $x+1=y-1$ Again $y+1=2x-2$

$\because x=y-2$ $\because 2x=y+3$

$\because x=\frac{y+3}{2}$

Now $\frac{y+3}{2}=y-2$

$\because y+3=2y-4$ $5+1=7-1=6$

$\because 2y=y+7$ $7+1=8=$ to $4\times 2=8$

$\because y=7$, and $x=y-2=5$

27. A

27. A Man bought two *Horses* with the *Trappings*, which together cost 100 *Crowns*. If the *Trappings* be laid on the *first Horse*, both the *Horses* will be of equal Value; but if the *Trappings* be laid on the *other Horse*, he will be *double* to the Value of the *first*. What did each of the *Horses* cost.

Numerically.

x, the Price of the first Horse.
y, the Price of the second.
$100 - y - x$, the Price of the Trappings.

Then $x + 100 - y - x = y$. And $y + 100 - y - x = 2x$

$\therefore 100 - y = 2y$ $\qquad \therefore 100 - x = 2x$

$\therefore 100 = 2y$ $\qquad \therefore 100 = 3x$

$\therefore y = \frac{100}{2} = 50$ $\qquad \therefore x = \frac{100}{3} = 33\frac{1}{3}$

$$\begin{array}{r} 100 \\ 83\frac{1}{3} \\ \hline 16\frac{2}{3} \end{array} \qquad \begin{array}{l} 33\frac{1}{3} + 16\frac{2}{3} = 50 \\ 50 + 16\frac{2}{3} = 66\frac{2}{3} \end{array}$$

Literally.

Let $100 = a$

Then $x + a - y - x = y$. And $y + a - y - x = 2x$

$\therefore a - y = y$ $\qquad \therefore a - x = 2x$

$\therefore a = 2y$ $\qquad \therefore a = 3x$

$\therefore y = \frac{a}{2} = 50$ $\qquad \therefore x = \frac{a}{3} = 33\frac{1}{3}$

28. A *Vintner* has two Sorts of Wine, *viz.* *White Lisbon* and *Canary*; which, if mixed in *equal* Parts, a *Gallon* of the mixed will cost 14 *Pence*; but if 2 *Gallons* of *White Lisbon*, be mixed with 3 of *Canary*, a *Gallon* will cost 15 *Pence*. What was the Price of a *Gallon* of each?

Numerically.

x, the Price of a Gallon of *White Lisbon*.
y, the Price of a Gallon of *Canary*.

Then $x+y=28$. And $2x+3y=75$

$\therefore x=28-y$ $\therefore 2x=75-3y$

$\therefore x=\frac{75-3y}{2}$

Now $\frac{75-3y}{2}=28-y$ $9+19=\frac{28}{2}=14$

$\therefore 75-3y=56-2y$ $18+57=\frac{75}{5}=15$

$\therefore 75=56+y$

$\therefore y=19$, and $x=18-y=9$

Literally.

Let $14=a$ Then $x+y=2a$ And $cx+dy=5b$

$15=b$ $\therefore x=2a-y$ $\therefore cx=5b-dy$

$2=c$ $\therefore x=\frac{5b-dy}{c}$

$3=d$

Now $\frac{5b-dy}{c}=2a-y$ $15=b$ $14=a$

5 $4=2c$

$\therefore 5b-dy=2ca-cy$ $75=5b$ $56=2ca$

$\therefore 5b=2ca+dy-cy$ $56=2ca$

$\therefore dy-cy=5b-2ca$ $1)19$

$\therefore y=\frac{5b-2ca}{d-c}=19$, and $x=2a-y=9$

29. A *Son* asked his *Father*, How old he was? His *Father* answered him thus: If you take away 5 from my Years, and *divide* the *Remainder* by 8, the *Quotient* will be $\frac{1}{3}$ of your Years. But if you *add* 2 to your Age, and *multiply* the Whole by 3, and *subtract* 7 from the *Product*, you will have the Number of the Years of my Age. What was the Age of the *Father* and *Son*?

Numerically.

x, the Age of the Father,

y, the Age of the Son.

Then

Then $\frac{x-5}{8}=\frac{y}{3}$ And $\frac{y+2}{3}$

$\therefore 3x-15=8y$ $\quad 3y+6-7=x$

$\therefore 3x=8y+15$ $\quad \therefore 3y-1=x$

$\therefore x=\frac{8y+15}{3}$

Now $\frac{8y+15}{3}=3y-1$

$\therefore 8y+15=9y-3$

$\therefore 15=y-3$

$\therefore y=18$, and $x=3y-1=53$

$$\begin{array}{r} 53 \\ 5 \\ \hline 8)48(6 \\ 3 \\ \hline 18 \end{array} \qquad \begin{array}{r} 18 \\ 2 \\ \hline 20 \\ 3 \\ \hline 60 \\ 7 \\ \hline 53 \end{array}$$

Literally.

Let $5=a$, $8=b$, $2=c$, $3=d$, $7=e$

Then $\frac{x-a}{b}=\frac{y}{d}$ And $\frac{y+c}{d}$

$\therefore dx-da=by$ $\quad dy+dc-e=x$

$\therefore dx=by+da$

$\therefore x=\frac{by+da}{d}$

Now $\frac{by+da}{d}=dy+dc-e$

$\therefore by+da=ddy+ddc-de$

$\therefore da=ddy-by+ddc-de$

$\therefore ddy-by=da+de-ddc$

$\therefore y=\frac{da+de-ddc}{dd-b}=18$

And $x=dy+dc-e=53$

$$\begin{array}{r} 15=da \\ 21=de \\ \hline 36=da+de \\ 18=ddc \\ \hline 1)18 \end{array} \qquad \begin{array}{r} 54=dy \\ 6=dc \\ \hline 60 \\ 7=e \\ \hline 53 \end{array}$$

30. To find 2 *Numbers*, to the *Sum* whereof, if you *add* 6, the Whole ſhall be *double* to the *greater*; and if you *ſubtract* 2 from their *Difference*, the *Remainder* will be ½ of the *leſſer*.

Nume-

[x] y Then $x+y+6=2x$. And $x-y-2=\frac{y}{2}$

$\therefore y+6=x$ $\qquad\qquad$ $\therefore 2x-2y-4=y$

Now $\frac{3y+4}{2}=y+6$ $\qquad\qquad$ $\therefore 2x-4=3y$

$\therefore 2x=3y+4$

$\therefore x=\frac{3y+4}{2}$

$\therefore 3y+4=2y+12$

$\therefore y+4=12$

$\therefore y=8$. And $x=y+6=14$

$14+8+6=28$. $\quad 6-2=4$

Literally.

Let $6=a$ $\quad$ Then $x+y+a=bx$. $\quad$ And $x-y-b=\frac{y}{b}$

$2=b$ $\qquad$ $\therefore bx-x=y+a$ $\qquad$ $\therefore bx-by-bb=y$

$\therefore x=\frac{y+a}{b-1}$ $\qquad$ $\therefore x=\frac{y+by+bb}{b}$

Now $\frac{y+a}{b-1}=\frac{y+by+bb}{b}$ $\qquad$ $12=ba$ $\quad$ $4bb$

$8=bbb$ $\quad$ $2=b$

$\therefore by+ba=by+bby+bbb-y-by-bb$ $\qquad$ $\frac{8}{4}$ $\quad$ $\frac{2}{2}$

$\therefore ba=bby+bbb-y+by-bb$ $\qquad$ $4=bb$ $\quad$ $\frac{1}{1}$

$\therefore bby-by-y=ba-bbb+bb$ $\qquad$ $1)8$

$\therefore y=\frac{ba-bbb+bb}{bb-b-1}=8$, and $x=\frac{y+a}{b-1}=14$

31. To find two *Numbers*, the *Product* whereof is 240, and the *Treble* of the *Greater divided* by the *Lesser* is 5.

Numerically.

[x] y Then $xy=240$, and $\frac{3x}{y}=5$

$\therefore x=\frac{240}{y}$ $\qquad$ $\therefore 3x=5y$

$\therefore x=\frac{5y}{3}$

Now

Now $\frac{5y}{3} = \frac{240}{y}$

$\therefore 5yy = 720$ | 20 | 12)60

$\therefore yy = \frac{720}{5} = 144$ | 12 | 5.

240

And $y = \sqrt[2]{144} = 12$

And $x = \frac{240}{y} = 20$

Literally.

Let $240 = a$, $5 = b$. Then $xy = a$. And $\frac{3x}{y} = b$

$\therefore x = \frac{a}{y}$ $\therefore 3x = by$

$\therefore x = \frac{by}{3}$

Now $\frac{a}{y} = \frac{by}{3}$ | $240 = a$ | $12 = by$

$\therefore 3a = byy$ | 3 | $5 = b$

$\therefore yy = \frac{3a}{b}$ | $b = 5)720 = 3a$ | $3)60 = by$

$\sqrt[2]{144}(12$ | 20

$\therefore y = \sqrt[2]{\frac{3a}{b}} = 12$, and $x = \frac{by}{3} = 20$

32. Two Men being minded to purchase a House; says *John* to *Thomas*, if you will give me $\frac{2}{3}$ of your Money, I can purchase the House my-self: But, says *Thomas* to *John*, if you will give me $\frac{3}{4}$ of yours, I shall be able to buy the House. How much Money had each of them?

Numerically.

x, the Money *John* had.

y, the Money *Thomas* had.

Then

Then $\frac{2y}{3}+x=1200$. And $\frac{3x}{4}+y=1200$

$\therefore 2y+3x=3600$ $\quad\quad$ $\therefore 3x+4y=4800$

$\therefore 3x=3600-2y$ $\quad\quad$ $\therefore 3x=4800-4y$

$\therefore x=\frac{3600-2y}{3}$ $\quad\quad$ $\therefore x=\frac{4800-4y}{3}$

Now $3600-2y=4800-4y$

$\therefore 3600+2y=4800$

$\therefore 2y=1200$

$\therefore y=\frac{1200}{2}=600$

And $x=\frac{3600-2y}{3}=800$

$$\begin{array}{r} 600 \\ 2 \\ \hline 3)1200 \\ \hline 400 \\ 800 \\ \hline 1200 \end{array} \qquad \begin{array}{r} 3600 \\ 1200 \\ \hline 3)2400 \\ \hline 800 \\ 3 \\ \hline 4)2400 \\ \hline 600 \\ 600 \\ \hline 1200 \end{array}$$

Literally.

Let $1200=a$

Then $x+\frac{2y}{3}=a$. And $y+\frac{3x}{4}=a$

$\therefore 3x+2y=3a$ $\quad\quad$ $\therefore 4y+3x=4a$

$\therefore 3x=3a-2y$ $\quad\quad$ $\therefore 3x=4a-4y$

$\therefore x=\frac{3a-2y}{3}$ $\quad\quad$ $\therefore x=\frac{4a-4y}{3}$

$$\begin{array}{r} 3600=2a \\ 1200=2y \\ \hline 3)2400=a-y \\ \hline 800 \end{array}$$

Now $3a-2y=4a-4y$

$\therefore 3a+2y=4a$

$\therefore 2y=a$

$\therefore y=\frac{a}{2}=600$. And $x=\frac{3a-2y}{3}=800$

33. Some

33. Some young *Men* and *Maids* had a Reckoning of 37 *Shillings* to pay for a *Treat*; and this was their Agreement, that every *Man* should pay 3 *Shillings*, and every *Maid* 2. Now, if there had been as *many Men*, as there were *Maids*, the Reckoning would have been 4 *Shillings* less than it was. How many young *Men* and *Maids* were there?

Numerically.

x, the Number of young Men.
y, the Number of Maids.

Then $3x+2y=37$. And $3y+2x=33$

$\because 3x=37-2y$ $\quad\because 2x=33-3y$

$\because x=\frac{37-2y}{3}$ $\quad\because x=\frac{33-3y}{2}$

Now $\frac{37-2y}{3}=\frac{33-3y}{2}$ $\quad 27+10=37$; $\quad 15+18=33$

$\because 74-4y=99-9y$

$\because 74+5y=99$

$\because 5y=25$

$\because y=\frac{25}{5}=5$, and $x=\frac{37-2y}{3}=9$

Literally.

Let $37=a$, $3=b$, $2=c$, $4=d$

Then $bx+cy=a$. $\quad$ And $by+cx=a-d$

$\because bx=a-cy$ $\quad\because cx=a-d-by$

$\because x=\frac{a-cy}{b}$ $\quad\because x=\frac{a-d-by}{c}$

Now $\frac{a-d-by}{c}=\frac{a-cy}{b}$

$\because ba-bd-bby=ca-ccy$

$\because ba-bd=bby+ca-ccy$

$\because bby-ccy=ba-bd-ca$

$\because y=\frac{ba-bd-ca}{bb-cc}=5$

And $x=\frac{a-cy}{b}=9$

$37=a$
$3=b$
$111=ba$
$12=bd$
99
$74=ca$
$5)25=bb-cc$
5

$37=cy$
$10=cy$
$3)27$
9

 34. A

34. A *General*, who had fought a Battle, upon reviewing his Army, whose *Foot* was 3 *Times* the Number of his *Horse*, finds, that before the Battle $\frac{1}{12}$ — 120 of his *Foot* had deserted; and of his *Horse* $\frac{1}{20}$ + 120; besides $\frac{1}{4}$ of his whole *Army* was sent into *Garrison*. Reckoning the *Sick* and the *Wounded*, $\frac{3}{8}$ of his *Army* remained. The rest that were wanting, were either *Slain* or taken *Prisoners*. Now if you add 3000, to the Number of the *Slain* or *Taken*, the *Sum* will be equal to $\frac{1}{2}$ of the *Foot* he had at first; I demand the Number of *Horse* and *Foot*.

Numerically.

x, the Number of Horse.

$3x$, the Number of Foot.

$4x$, the whole Army.

$\frac{3x}{12} - 120$, is $\frac{3x-1440}{12} = \frac{x-480}{4}$ Foot Deserters.

$\frac{x}{20} + 120$, is $\frac{x+2400}{20}$ Horse Deserters.

x, sent into Garrison.

$\frac{12x}{8}$ is $\frac{3x}{2}$ Remained.

$$\frac{\dfrac{448x}{40x-19200+8x+19200+160x+240x}}{\dfrac{\dfrac{x-480}{4}+\dfrac{x+2400}{20}+\dfrac{x}{1}+\dfrac{3x}{2}}{160}}$$

$$\begin{array}{r} 40x \\ 8x \\ 160x \\ 240x \\ \hline 448x \end{array}$$

Then $4x - \frac{448x}{160}$ is $\frac{640x-448x}{160} = \frac{192x}{160} = \frac{6x}{5}$

Now $\frac{6x}{5} + 3000$, is $\frac{6x+15000}{5}$

$\because \frac{6x+15000}{5} = \frac{3x}{2}$

$\because 12x+30000 = 15x$

$\because 30000 = 3x$

$\because x = \frac{30000}{3} = 10000$

$$\begin{array}{r} 12)30000 \\ \hline 2500 \\ 120 \\ \hline 2380 \end{array}$$

Horse	10000	40000	
Foot	30000	3	
Army	40000	8)120000	
		15000	

$$\begin{array}{r} 2|0)1000|0 \\ \hline 500 \\ 120 \\ \hline 620 \end{array}$$

Foot Deserters - -	2380	
Horse Deserters - -	620	
In Garrison - - -	10000	12000
Remained - - - -	15000	3000
	28000	15000 = to ½ the Foot.
	40000	
Slain or Taken	12000	

Literally.

Let $120 = a$

$3000 = b$

$\frac{3x}{12} - a$, is $\frac{3x-12a}{12} = \frac{x-4a}{4}$ Foot Deserters.

$\frac{x}{20} + a$, is $\frac{x+20a}{20}$ Horse Deserters.

$\frac{4x}{4}$ is x, in Garrison.

$\frac{12x}{8}$ is $\frac{3x}{2}$ Remained.

$$\frac{448x}{\dfrac{40x-160a+8x+160a+160x+240x}{\dfrac{\frac{x-4a}{4}+\frac{x+20a}{20}+\frac{x}{1}+\frac{3x}{2}}{160}}}$$

$$\begin{array}{r} 40x \\ 8x \\ 160x \\ 240x \\ \hline 448x \end{array}$$

Then $4x - \frac{448x}{160}$ is $\frac{6x}{5}$ as afore.

And $\frac{6x}{5} + b$ is $\frac{6x + 5b}{5} = \frac{3x}{2}$

$\therefore 12x + 10b = 15x$

$\therefore 10b = 3x$

$\therefore x = \frac{10b}{3} = 10000$

35. To divide 100, *twice* into 2 Parts, so that the *major* Part of the *first Division* may be *treble* to the *minor* Part of the *second*, and the *major* Part of the *second* may be *double* to the *minor* Part of the *first*.

Numerically.

$\llcorner x \quad \urcorner\, 100 - x \qquad \llcorner y \quad \urcorner\, 100 - y$

Then $x = 300 - 3y$. And $y = 200 - 2x$

Now $\frac{200 - y}{2} = 300 - 3y$ $\quad \therefore 2x + y = 200$

$\therefore 2x = 200 - y$

$\therefore x = \frac{200 - y}{2}$

$\therefore 200 - y = 600 - 6y$

$\therefore 200 + 5y = 600$

$\therefore 5y = 400$

$\therefore y = \frac{400}{5} = 80$ $\qquad \llcorner 60 \quad \urcorner 40 \quad \llcorner 80 \quad \urcorner 20$

And $x = 300 - 3y = 60$

Literally.

Let $100 = a$

Then $x = 3a - 3y$. And $y = 2a - 2x$

Now $\frac{2a - y}{2} = 3a - 3y$ $\quad \therefore y + 2x = 2a$

$\therefore 2x = 2a - y$

$\therefore x = \frac{2a - y}{2}$

$\therefore 2a - y = 6a - 6y$

$\therefore 2a + 5y = 6a$ $\qquad 5)\underline{400}$ $\;80$

$\therefore 5y = 4a$

$\therefore y = \frac{4a}{5} = 80$, and $x = 3a - 3y = 60$

36. To divide 30, *twice* into 2 Parts, so that the *major* Part of the *first Division*, with the *minor* Part of the *second*, may be 33; and the Sum of the *minor* Parts, subtracted from the Sum of the *major*, may leave 14.

Numerically.

$$\sqsubset x \quad \sqsupset 30-x \quad \sqsubset y \quad \sqsupset 30-y$$

Then $x+30-y=33$, and $x+y-60+x+y=14$

$\because x=3+y$

$$\because 2x+2y-60=14$$
$$\because 2x+2y=74$$
$$\because 2x=74-2y$$
$$\because x=\frac{74-2y}{2}$$

$$\begin{array}{r} 30-x \\ 30-y \\ \hline 60-x-y \end{array}$$

Now $\dfrac{74-2y}{2}=3+y$

$$\because 74-2y=6+2y$$
$$\because 74=6+4y$$
$$\because 68=4y$$
$$\because y=\frac{68}{4}=17\text{, and } x=3+y=20$$

$$\sqsubset 20 \ \sqsupset 10 \qquad \sqsubset 17 \ \sqsupset 13$$

$$\begin{array}{r} 20 \\ 13 \\ \hline 33 \end{array} \qquad \begin{array}{r} 20 \\ 17 \\ \hline 37 \\ 23 \\ \hline 14 \end{array} \qquad \begin{array}{r} 13 \\ 10 \\ \hline 23 \end{array}$$

Literally.

Let $30=a$ $\quad \sqsubset x \quad \sqsupset a-x \quad \sqsubset y \quad \sqsupset a-y$

$33=b$

$14=c$ $\quad$ Then $x+a-y=b$

$$\because x=b-a+y$$

$$\begin{array}{r} a-x \\ a-y \\ \hline 2a-x-y \end{array}$$

Again, $x+y-2a+x+y=c$

$$\because 2x+2y-2a=c$$
$$\because 2x+2y=c+2a$$
$$\because 2x=c+2a-2y$$
$$\because x=\frac{c+2a-2y}{2}$$

$$\begin{array}{r} c=14 \\ 4a=120 \\ \hline 134 \\ 2b-66 \\ \hline 4)68 \\ \hline 17 \end{array}$$

Now $\dfrac{c+2a-2y}{2}=b-a+y$

$\because c+2a-2y=2b-2a+2y$

$\because c+2a=2b-2a+4y$

$\because 4y+2b=c+4a$

$\because 4y=c+4a-2b$

$\because y=\dfrac{c+4a-2b}{4}=17$ & $x=b-a+y=20$

$$\begin{array}{r} b=33 \\ a=\underline{30} \\ 3 \\ y=\underline{17} \\ 20 \end{array}$$

37. A *Man*, his *Wife*, and his *Son's* Age together, make 96 *Years*; the *Husband's*, with the *Son's*, makes the *Wife's* + 15; and the *Wife's*, with the *Son's*, makes the *Husband's* + 2. What was the Age of each?

Numerically.

x. The Father's Age.
y, the Mother's Age.
z, the Son's Age.

Then $x+y+z=96$, and $x+z=y+15$, & $y+z=x+2$

$\because x=96-y-z$. $\because x=y+15-z$ $\because x=y+z-2$

Now $96-y-z=y+15-z$, & $96-y-z=y+z-2$

$\because 96-y=y+15$ | $\because 96-z=2y+z-2$

$\because 96=2y+15$ | $\because 96=2y+2z-2$

$\because 2y=81$ | $\because 98=2y+2z$

$\because y=\dfrac{81}{2}=40\frac{1}{2}$ | $\because 2z=98-2y$

| $\because z=\dfrac{98-2y}{2}=8\frac{1}{2}$

$$\begin{array}{r} 98 \\ 81 \\ 2)\overline{17} \\ \overline{} \\ 8\frac{1}{2} \end{array}$$

and $x=96-y-z=47$

$47+40\frac{1}{2}+8\frac{1}{2}=96$

$47+8\frac{1}{2}=55\frac{1}{2}=40\frac{1}{2}+15=55\frac{1}{2}$

$40\frac{1}{2}+8\frac{1}{2}=49=47+2=49$.

Literally.

Let $96=a$ Then $x+y+z=a$
$15=b$ $\because x=a-y-z$
$2=c$

Again,

Again $x+z=y+b$. And $y+z=x+c$

$\therefore x=y+b-z$ $\therefore x=y+z-c$

Now $a-y-z=y+b-z$. And $a-y-z=y+z-c$

$\therefore a-y=y+b$ | 96 | $\therefore a-z=2y+z-c$

$\therefore a=2y+b$ | 15 | $\therefore a=2y+2z-c$

$\therefore 2y=a-b$ | $2|81$ | $\therefore 2z=a+c-2y$

$\therefore y=\frac{a-b}{2}=40\frac{1}{2}$ | $40\frac{1}{2}$ | $\therefore z=\frac{a+c-2y}{2}=8\frac{1}{2}$

$x=y+b-z=47$

$$\begin{array}{r} 40\frac{1}{2}=y \\ 15=b \\ \hline 55\frac{1}{2} \\ 8\frac{1}{2}=z \\ \hline 47 \end{array} \qquad \begin{array}{r} 96=a \\ 2=c \\ \hline 98 \\ 81=2y \\ \hline 2|17 \\ \hline 8\frac{1}{2} \end{array}$$

38. Three *Merchants*, from two different Fairs, met together at an Inn, where they reckon up their Gains, and find them to be the Sum of 780 *Crowns*. If you add the Gain of the *firſt* and *ſecond* together, and from the Sum, ſubtract the Gain of the *third*, the Remainder will be the Gain of the *firſt* + 82. But if you add the Gain of the *ſecond* and *third* together, and from that Sum, ſubtract the Gain of the *firſt*, the Remainder will be the Gain of the *third* — 43. What was the Gain of each?

Numerically.

x, the Gain of the firſt Merchant.
y, the Gain of the ſecond.
z, the Gain of the third.

Then $x+y+z=780$. And $x+y-z=x+82$

$\therefore x=780-y-z$ $\therefore y-z=82$

$\therefore y=z+82$

Again

Again $y+z-x=z-43$

$\therefore y=x-43$ | Now $780-y-z=y+43$

$\therefore x=y+43$ | $\therefore 780-z=2y+43$

$\therefore 2y=737-z$

$\therefore y=\frac{737-z}{2}$

Then $\frac{737-z}{2}=z+82$

$\therefore 737-z=2z+164$

$\therefore 737=3z+164$

$\therefore 3z=573$

$\therefore z=\frac{573}{3}=191$

$y=z+82=273$

$x=y+43=316$

$$\begin{array}{r}316\\273\\\underline{191}\\780\end{array}\qquad\begin{array}{r}316\\\underline{273}\\589\\\underline{191}\\398\end{array}\qquad\begin{array}{r}316\\\underline{82}\\398\end{array}\qquad\begin{array}{r}273\\\underline{191}\\464\\\underline{316}\\148\end{array}\qquad\begin{array}{r}191\\\underline{43}\\148\end{array}$$

Literally.

Let $780=a$ | Then $x+y+z=a$

$\therefore 82=b$ | $\therefore x=a-y-z$

$\therefore 43=c$

Again $x+y-z=x+b$. And $y+z-x=z-c$

$\therefore y-z=b$ | $\therefore y=x-c$

$\therefore y=b+z$ | $\therefore x=y+c$

Now $a-y-z=y+c$ | Then $\frac{a-c-z}{2}=b+z$

$\therefore a-z=2y+c$

$\therefore 2y=a-c-z$ | $\therefore a-c-z=2b+2z$

$\therefore y=\frac{a-c-z}{2}$ | $\therefore a-c=2b+3z$

$\therefore 3z=a-c-2b$

$\therefore z=\frac{a-c-2b}{3}=191$

$$780 = a$$
$$\underline{43} = c$$
$$737$$
$$164 = 2b$$
$$3\,|\,\underline{573}$$
$$191$$

$$z = 191$$
$$b = 82$$
$$y = b + z = 273$$
$$c = 43$$
$$x = y + c = 316$$

39. Three *Persons*, *A*, *B*, and *C*, owe a certain Sum of Money, so that *A* and *B* together owe 210 *Crowns*, *B* and *C* 290, and *C* and *A* 300. What did each of them owe?

Numerically.

x, Crowns, the Debt of *A*.
y, Crowns, the Debt of *B*.
z, Crowns, the Debt of *C*.

Then $x + y = 210$. And $y + z = 290$ & $x + z = 300$

$\because x = 210 - y \quad \because y = 290 - z \quad \because x = 300 - z$

Now $210 - y = 300 - z$ Then $z - 90 = 290 - z$

$\because 210 = y + 300 - z \quad \because 2z - 90 = 290$

$\because z - 90 = y \quad \because 2z = 380$

$y = 290 - z = 100 \quad \because z = \dfrac{380}{2} = 190$

$x = 210 - y = 110$

$$\begin{array}{ccc} 100 & 100 & 110 \\ \underline{100} & \underline{190} & \underline{190} \\ 210 & 290 & 300 \end{array}$$

Literally.

Let $210 = a$ Then $x + y = a$ & $y + z = b$
$290 = b \quad \because x = a - y \quad \because y = b - z$
$300 = c$ Again $x + z = c$
$\because x = c - z$

Now $a - y = c - z$ Then $a - c + z = b - z$

$\because a = y + c - z \quad \because a - c + 2z = b$

$\because y = a - c + z \quad \because 2z = b + c - a$

$\because z = \dfrac{b + c - a}{2} = 190$

$290 = b$ $\quad y = b - z = 100$
$300 = c$
$\overline{590}$ $\quad x = c - z = 110$ $\quad 290 = b$
$210 = a$ $\quad 300 = c$ $\quad 190 = z$
$2|\overline{380}$ $\quad 190 = z$ $\quad \overline{100}$
$\overline{190}$ $\quad \overline{110}$

40. To find *three* Numbers, ſo that the *firſt* with $\frac{1}{2}$ the reſt, the *ſecond* with $\frac{1}{3}$ the reſt, and the *third* with $\frac{1}{4}$ the reſt; may each make 34.

Numerically.

x, the firſt Number.
y, the ſecond Number.
z, the third Number.

Then $x + \frac{y+z}{2} = 34$, and $y + \frac{x+z}{3} = 34$

$\therefore 2x + y + z = 68$ $\qquad \therefore 3y + x + z = 102$
$\therefore 2x = 68 - y - z$ $\qquad \therefore x = 102 - 3y - z$
$\therefore x = \frac{68 - y - z}{2}$

Again $z + \frac{x+y}{4} = 34$
$\therefore 4z + x + y = 136$
$\therefore x = 136 - 4z - y$

Now $\frac{68 - y - z}{2} = 102 - 3y - z$

$\therefore 68 - y - z = 204 - 6y - 2z$
$\therefore 68 + 5y - z = 204 - 2z$
$\therefore 5y - z = 136 - 2z$
$\therefore 5y = 136 - z$
$\therefore y = \frac{136 - z}{5}$

Again

Again $\dfrac{68-y-z}{2}=136-4z-y$

$\because\ 68-y-z=272-8z-2y$

$\because\ 68+y-z=272-8z$

$\because\ y-z=204-8z$

$\because\ y=204-7z$

Then $\dfrac{136-z}{5}=204-7z$

$\because\ 136-z=1020-35z$

$\because\ 136+34z=1020$

$\because\ 34z=884$

$\because\ z=\dfrac{884}{34}=26$

$y=204-7z=22$

$x=102-3y=10$

$$34)884(26 \qquad \begin{array}{r} 204 \\ \hline 0 \end{array}$$

$$\begin{array}{r} 22 \\ 3 \\ \hline 66 \\ 26 \\ \hline 92 \\ 102 \\ \hline 10 \end{array} \qquad \begin{array}{r} 26 \\ 7 \\ \hline 182 \\ 204 \\ \hline 22 \\ \\ 22 \\ 10 \\ 4|\overline{32} \\ \hline 8 \end{array}$$

$$\begin{array}{r} 10 \\ 24 \\ \hline 34 \end{array} \quad \begin{array}{r} 22 \\ 12 \\ \hline 34 \end{array} \quad \begin{array}{r} 26 \\ 8 \\ \hline 34 \end{array} \quad \begin{array}{r} 22 \\ 26 \\ 2|\overline{48} \\ \hline 24 \end{array} \quad \begin{array}{r} 10 \\ 26 \\ 3|\overline{36} \\ \hline 12 \end{array}$$

Literally.

Let $34=a$. Then $x+\dfrac{y+z}{2}=a$

$\because\ 2x+y+z=2a$

$\because\ 2x=2a-y-z$

$\because\ x=\dfrac{2a-y-z}{2}$

Again $y+\dfrac{x+z}{3}=a$, and $z+\dfrac{x+y}{4}=a$

$\because\ 3y+x+z=3a \qquad \because\ 4z+x+y=4a$

$\because\ x=3a-3y-z \qquad \because\ x=4a-4z-y$

Now

Now $\frac{2a-y-z}{2} = 3a-3y-z$

$\because\ 2a-y-z = 6a-6y-2z$

$\because\ 2a+5y-z = 6a-2z$

$\because\ 5y-z = 4a-2z$

$\because\ 5y = 4a-z$

$\because\ y = \frac{4a-z}{5}$

Again $\frac{2a-y-z}{2} = 4a-4z-y$

$\because\ 2a-y-z = 8a-8z-2y$

$\because\ 2a+y-z = 8a-8z$

$\because\ y-z = 6a-8z$

$\because\ y = 6a-7z$

Then $\frac{4a-z}{5} = 6a-7z$

$\because\ 4a-z = 30a-35z$

$\because\ 4a+34z = 30a$

$\because\ 34z = 26a$

$\because\ z = \frac{26a}{34} = 26$

$y = 6a-7z = 22$

$x = 3a-3y-z = 10$

$34 = a$
26
204
68
$34)884(26$
204
0

$34 = a$
6
$204 = 6a$
$182 = 7z$
22

$26 = z$
7
$182 = 7z$
$22 = y$
3
$66 = 3y$

$34 = a$
3
$102 = 3a$
$66 = 3y$
36
$26 = z$
10

The

The Extraction *of* Roots.

Note, WHEN a ſmall Figure is ſet at the Head of a Letter in any Quantity, it denotes the *Power* of that Letter, *viz.* If 2, the *Square* of it; if 3, the *Cube*, *&c.*

Thus a^2, is *aa*; a^3, is *aaa*; a^4, is *aaaa*, *&c.*

Powers, by ſome called *Involution* and *Evolution*, are nothing elſe but *Products*, ariſing from a continual *Multiplication*, of any aſſumed *Side* or *Root*: For ſuppoſing, that any *Root* is the *firſt Power* of itſelf, or that the *firſt Power* ariſes when the *Root* is *multiplied* into *Unity*; if then the ſame *Root* be *multiplied* into itſelf, it produces its *Square*, which is the *ſecond Power*, whoſe *Index*, or Numeral Exponent, is 2. The *Square*, *multiplied* by the ſame *Root*, produces its *Cube*, which is the *third Power*, whoſe *Index* is 3; and ſo on, *ad infinitum*, according to the Number of their Dimenſions, of which they are compounded. But the more compounded the *Powers* are, the higher they are eſteemed to be; and therefore they are not diſtinguiſhed, by bare Name or Denomination only, but by their Order and Degrees, which conſtitute a Sort of *Progreſſional* Scale, in which the *Quantities* do, as it were, aſcend and deſcend.

But we muſt alſo obſerve, that the *Powers*, which are above the *Cubick*, are not only produced from the *Root* itſelf, *multiplied* into the Degree next going before, but alſo from the mutual *Multiplication* of the *inferior Powers*, as their very Names declare: For the *Biquadrate*, or *Square Square*, which is the *fourth Power*, ariſes not only from the *Root*, multiplied into the *Cube*, but alſo from the *Square*, multiplied into itſelf. Hence this *Power*, that is the *Biquadrate*, is alſo a *Square*; and the like you may judge of the reſt.

Every *Root* is either ſimple, as *a*, 2*a*, 3*a*, *&c.* or compounded, that is, *Binomials* or *Trinomials*, *&c.* as $a+b$, $a-b$, $a+b+c$, *&c.*

The *Genesis* of any *Power*, is the Production of the same *Power*, by *Multiplication* from a given *Root*, and therefore is very easy from a *Simple Root*. For Instance, if the *Root* be *a*, its *Square* will be *aa*, *Cube aaa*, *Biquadrate aaaa*, *&c.* If the *Root* be 2*a*, the *Square* will be 4*aa*, *Cube* 8*aaa*, *Biquadrate* 16*aaaa*, *&c.* for the Numbers set before the Letters are *multiplied* by themselves.

Nor is the Production of *Powers* from a *Compound Root* difficult, tho' it require more Labour, as will appear by the *Involution* of the *Root* $a+b$, as followeth.

$$\begin{array}{l}
a+b \\
a+b \\
\hline
aa+ab \\
ab+bb \\
\hline
aa+2ab+bb. \quad \text{Square.} \\
\qquad a+b \\
\hline
aaa+2aab+abb \\
aab+2abb+bbb \\
\hline
aaa+3aab+3abb+bbb \quad \text{Cube.} \\
\qquad\qquad a+b \\
\hline
a^4+3a^3b+3a^2b^2+ab^3 \\
a^3b+3a^2b^2+3ab^3+b^4 \\
\hline
a^4+4a^3b+6a^2b^2+4ab^3+b^4 \quad \text{Biquadrat.} \\
\qquad\qquad a+b \\
\hline
a^5+4a^4b+6a^3b^2+4a^2b^3+ab^4 \\
a^4b+4a^3b^2+6a^2b^3+4ab^4+b^5 \\
\hline
a^5+5a^4b+10a^3b^2+10a^2b^3+5ab^4+b^5 \quad \text{5th Power.} \\
\qquad\qquad a+b \\
\hline
a^6+5a^5b+10a^4b^2+10a^3b^3+5a^2b^4+ab^5 \\
a^5b+5a^4b^2+10a^3b^3+10a^2b^4+5ab^5+b^6 \\
\hline
a^6+6a^5b+15a^4b^2+20a^3b^3+15a^2b^4+6ab^5+b^6 \quad \text{6th Power}
\end{array}$$

Thus $a+b$ *involved*, gives a *Theorem* by which the *Root* of any *Power* may be extracted, and will be evident by the following Examples.

Note: In the Extraction of the *Root* of any *Quantity*, you must place a Point over the last Figure; so pointing off *two* Figures for the *Square*, *three* for the *Cube*, *four* for the *Biquadrat*, &c. the Number of Points shews the Number of Figures of which the *Root* will consist.

$$aa+2ab+bb$$

	$2\ 1\ 9.\ 6\ 9$		
	$\sqrt{48267.9482}$	$2=a$	$2=a$
	$4=aa$	$2=a$	2
$1:\ 2a=4)8$		$4=aa$	$4=2a$
	$4=2ab$		$1=b$
$2=a$			
$1=b$	42		$4=2ab$
	$1=bb$		
$2:\ 2a=42)416$		$21=a$	$219=a$
	$378=2ab$	2	2
$21=a$			
$9=b$	387	$42=2a$	$438=2a$
	$81=bb$	9	$6=b$
$3:\ 2a=438)3069$		$378=2ab$	$2628=2ab$
	$2628=2ab$		
$219=a$			
$6=b$	4414		$2196=a$
	$36=bb$		2
$4:\ 2a=4392)43788$			$4392=2a$
	$39528=2ab$		9
$2196=a$			
$9=b$	42602		$39528=2ab$
	$81=bb$		
	42521		

$$aaa + 3aab + 3abb + bbb$$

	$\sqrt[3]{748269714.832654}$ = 9 0 7 . 8 6	In the first Step.
	729=*aaa*	90=*a*
1.		90=*a*
3*aa*=24300)192697		
	170100=3*aab*	8100=*aa*
90=*a*	225971	3
7=*b*	13230=3*abb*	24300=3*aa*
	2127414	7
	343=*bbb*	170100=3*aab*
2.		
3*aa*=2467947)21270718		90=*a*
	19743576=3*aab*	3
107=*a*		
8=*b*	15271423	270=3*a*
	174144=3*abb*	49=*bb*
	150972792	2430
	512=*bbb*	1080
3.		
3*aa*=247230252)1509722806		13230=3*abb*
	1483381512=3*aab*	
9078=*a*		
6=*b*	263412945	7=*b*
	980424=3*abb*	7
	2624325214	49=*bb*
	216=*bbb*	7
	2624324998	343=*bbb*

The second and third Steps are wrought after the same Manner as the first Step, which I leave to the Learner.

$$aaaa + 4aaab + 6aabb + 4abbb + bbbb$$

$$\sqrt[4]{7948267.00000000} \quad \overline{5\quad 3\ .\ 0\quad 9}$$

$$\begin{array}{l}
625 = aaaa \\
\hline
\end{array}$$

1.

$$\begin{array}{rl}
4aaa = 500)\,1698 & \\
1500 & = 4aaab \\
\hline
1982 & \\
1350 & = 6aabb \\
\hline
6326 & \\
540 & = 4abbb \\
\hline
57867 & \\
81 & = bbbb
\end{array}$$

$$a = 5 \qquad b = 3$$

$$\begin{array}{rl}
125 & = aaa \\
4 & \\
\hline
500 & = 4aaa \\
3 & \\
\hline
1500 & = 4aaab
\end{array}$$

$$\begin{array}{rl}
25 & = aa \\
6 & \\
\hline
150 & = 6aa \\
9 & = bb \\
\hline
1350 & = 6aabb
\end{array}$$

$$\begin{array}{rl}
5 & = a \\
5 & = a \\
\hline
25 & = aa \\
5 & \\
\hline
125 & = aaa \\
5 & \\
\hline
625 & = aaaa
\end{array}$$

$$\begin{array}{rl}
20 & = 4a \\
27 & = bbb \\
\hline
540 & = 4abbb
\end{array}$$

2.

$$\begin{array}{rl}
4aaa = 595508000)\,5778600000 & \\
5359572000 & = 4aaab \\
\hline
4190280000 & \\
136517400 & = 6aab \\
\hline
40537626000 & \\
1545480 & = 4abbb \\
\hline
405360805200 & \\
6561 & = bbbb \\
\hline
405360798639 &
\end{array}$$

$$530 = a \qquad 9 = b$$

$$\begin{array}{rl}
bb & = 9 \\
bb & = 9 \\
\hline
81 & = bbbb
\end{array}$$

The first Step, in its Operation exhibited, I think sufficient to shew the whole Proceeding.

$$a^5+5a^4b+10a^3b^2+10a^2b^3+5ab^4+b^5$$

$$\sqrt[5]{754287694278.42597}\quad (2\ 3\ 7\ .\ 4$$

	$32=a^5$	
$1:\ 5a^4=80$	$)434$	$2=a$
	$240=5a^4b$	$2=a$
$2=a$	1942	$4=a^2$
$3=b$	$720=10a^3bb$	$2=a$
$16=a^4$	12228	$8=a^3$
5	$1080=10a^2b^3$	$2=a$
$80=5a^4$	111487	$16=a^4$
3	$810=5ab^4$	$2=a$
$240=5a^4b$	1106776	$32=a^5$
	$243=b^5$	
$2:\ 5a^4=1399205$	$)11065339$	$3=b$
	$9794435=5a^4b$	$3=b$
$23=a$	12709044	$9=b^2$
$7=b$	$5961830=10a^3b^2$	$3=b$
	67472142	$27=b^3$
	$1814470=10a^2b^3$	$3=b$
	656576727	$81=b^4$
	$276115=5ab^4$	3
	6563006128	$243=b^5$
	$16807=b^5$	
$3:\ 5a^4=15774782805$	$)65629893214$	
	$63099131220=5a^4b$	
$237=a$	25307619942	
$4=b$	$2129928480=10a^3b^2$	
	231776914625	
	$35948160=10a^2b^3$	
	2317409664659	
	$303360=5ab^4$	
	23174093612997	
	$1024=b^5$	
	23174093611973	

$$\begin{array}{lll}
8 = a^3 & 4 = a^2 & 81 = b^4 \\
\underline{10} & \underline{10} & \underline{10 = 5a} \\
80 = 10a^3 & 40 = 10a^2 & 810 = 5ab^4 \\
\underline{9 = bb} & \underline{27 = b^3} & \\
720 = 10a^3bb & 1080 = 10a^2b^3 &
\end{array}$$

In the like Manner, the *Root* of any *Quantity* in any *Power*, may be obtained; the which I ſhall leave to the Learner, holding the preceeding *Examples* ſufficient for his Inſtruction.

The *Proof* of the preceeding *Examples* I have omitted, as needleſs; but I would adviſe the Learner to prove every Step as he proceeds, becauſe it will facilitate the Work of the enſuing Steps, as will appear by the *Proof* of the *firſt* Step in the preceeding *Example*, as followeth.

$$\begin{array}{rr}
 & 23 = a \\
 & \underline{23 = a} \\
 & 69 \\
 & \underline{46} \\
 & 529 = aa \\
 & \underline{23 = a} \\
 & 1587 \\
 & \underline{1058} \\
 & 12167 = aaa \\
 & \underline{23 = a} \\
 & 36501 \\
 & \underline{24334} \\
279841 & 279841 = aaaa \\
\underline{5} & \underline{23 = a} \\
1399205 & 839523 \\
 & \underline{559682} \\
 & 6436343 = aaaaa \\
\text{The Remainder added - - -} & \underline{1106533} \\
 & 7542876
\end{array}$$

Thus having before you 279841 = *aaaa*, which *multiplied* by 5, you very easily obtain the *Divisor* for the next Step: Then as easily follows 5*aaaab*, 10*aaabb*, 10*aabbb*, 5*abbbb*, and *bbbbb*, as is plain in the preceeding *Example*.

ARITHMETICAL PROGRESSION,

IS when any *Rank*, or *Series* of Numbers, do either *increase*, or *decrease*, by an *equal* Interval, or *common* Difference.

As 1 : 2 : 3 : 4 : 5, &c. Or 2 : 4 : 6 : 8 : 10 : 12, &c.

Or as 1 : 3 : 5 : 7 : 9, &c. Or 1 : 4 : 7 : 10 : 13, &c.

If any *three* Numbers be in *Arithmetical Progression*, the Sum of the *two Extremes* will be equal to the *Double* of the *Mean*.

As 2 : 3 : 4. Or 5 : 7 : 9. Or 7 : 10 : 13

$$\begin{array}{cc} 4 & 2 \\ \hline 6 & =6 \end{array} \qquad \begin{array}{cc} 9 & 2 \\ \hline 14 & =14 \end{array} \qquad \begin{array}{cc} 2 & 7 \\ \hline 20 & =20 \end{array}$$

If any *four* Numbers be in *Arithmetical Progression*, the Sum of the *two Extremes* will be equal to the Sum of the *two Means*.

As 2 : 3 : 4 : 5. Or 1 : 4 : 7 : 10

$$\begin{array}{ccc} 5 & & 3 \\ \hline 7 & = & 7 \end{array} \qquad \begin{array}{ccc} 10 & & 4 \\ \hline 11 & = & 11 \end{array}$$

From hence it is evident, that if never so many Numbers be in *Arithmetical Progression*, the Sum of the *two Extremes* will always be equal to the Sum of any *two Means*, that are *equally* distant from

from those *Extremes*; and if the Number of Terms be odd, the Sum of the *two Extremes* will be *double* to the *middle* Term.

As 2 : 4 :	6 : 8 :	10 : 12 :	14 : 16 :	18 : 20
20	16	12	8	4
22	22	22	22	22

Again, 4 : 7 :	10 : 13 : 16 :	19 : 22
22	2	7
26	26	26

Now it will be very easy to conceive, that if the Sum of the *two Extremes* be multiplied by the Number of Terms, the Product will be *double* the Sum of all the Terms; and also, that if the Difference betwixt the *two Extremes* be divided by the Number of Terms, less 1, the *Quotient* will be the *Common* Difference of the *Series*.

As 3 : 6 : 9 : 12 : 15 : 18

3	3
18	6
21	9
6 the Number of Terms.	12
126	15
	18
	63
	2
	126

From 18
Take 3

Numb. of Terms, less 1, is - - - } 5)15(3 the Common Difference.

Now for the easier resolving such *Questions* as may depend upon *Progressional Quantities*,

Let the first Term of any *Progressional Quantity* be equal to - - - - - - - - - a

The *Last* Term - - - - - - u

The *Number* of Terms - - - - n

The *Common* Difference - - - - d

The *Sum* of all the Terms - - - - s

Then

Then $\frac{u-a}{n-1}=d$. That is, the Difference betwixt the *Extremes*, divided by the *Number* of Terms, less 1, is *equal* to the *Common* Difference.

Again, $na+nu=2s$. That is, the Sum of the *Extremes*, multiplied by the *Number of Terms*, is equal to *twice* the Sum of all the Terms.

Now by the Help of these *two Equations*, if any *three* of the said *five* Parts be given, the other *two* may be very easily found, as will appear by the following *Questions*.

1. Suppose a *Basket* were fixed in a certain Place, and 20 *Stones* laid in a right Line, the *first* Stone a *Yard* from the *Basket*, and the rest each a *Yard* from one another: It is required, what Distance a Man must go, to gather up those *Stones* singly, one after another, returning with every *Stone*, to put it into the *Basket*.

In this Question we have the *first* Term 2 *Yards*, the *last* Term 40 *Yards*, and the *Number* of Terms 20, to find the Sum of all the Terms.

Then $na+nu=2s$

$$\because\ s=\frac{na+nu}{2}=420 \text{ Yards.}$$

$20=n$	$40=u$	$a=2$
$2=a$	$20=n$	$u=40$
$40=na$	$800=nu$	$n=20$
	40	
	2)840(420	

2. A *Debtor* agrees with his *Creditor*, to pay his Debt at 12 several Payments, in *Arithmetical Progression*. The *first* Payment to be 10 *l.* and the

last

last 98. What was the whole Debt, and what must be each Payment?

In this *Question* we have the *first* Term 10*l.* and the *last* 98, and the *Number* of Terms 12, to find the *Sum* of all the Terms, and *common* Difference.

$a=10$ Then $na+nu=2s$
$u=98$ $\therefore s=\dfrac{na+nu}{2}=648$ £.
$n=12$

$$\begin{array}{r} 98=u \\ 12=n \\ \hline 1176=nu \end{array}$$

$$\begin{array}{r} 12=n \\ 10=a \\ \hline 120=na \end{array}$$

$$\begin{array}{r} 1176=nu \\ 120=na \\ \hline 2)1296 \\ \hline 648 \text{ £.} \end{array}$$

Again $\dfrac{u-a}{n-1}=d=8$

$$\begin{array}{r} 98=u \\ 10=a \\ \hline n-1=11)88(8 \\ \hline 0 \end{array}$$

1 Payment	10	7 Payment	58
2	18	8	66
3	26	9	74
4	34	10	82
5	42	11	90
6	50	12	98
	180		468
	468		
	648		

3. Of 8 *Brethen*, the *youngest* was 27 *Years* old, the *eldest* 50; each differed alike in Age from o-ther. What was the Age of each?

$a=27$
$u=50$ Then $\dfrac{u-a}{n-1}=d=3\frac{2}{7}$
$n=8$

$$\begin{array}{r} 50=u \\ 27=a \\ \hline n-1=7)23(3\frac{2}{7} \end{array}$$

1	27	5	$40\frac{1}{7}$
2	$30\frac{2}{7}$	6	$43\frac{3}{7}$
3	$33\frac{4}{7}$	7	$46\frac{5}{7}$
4	$36\frac{6}{7}$	8	50

4. One had divers Sons, the *youngest* 6 *Years* old, the *eldest* 40; each exceeding the other 2 *Years*. How many Sons had he?

$a = 6$
$u = 40$
$d = 2$

Then $\dfrac{u-a}{n-1} = d$

$\because u - a = nd - d$
$\because u - a + d = nd$
$\because n = \dfrac{u - a + d}{d} = 18$

$$\begin{array}{r l} 40 & = u \\ 6 & = a \\ \hline 34 & = u - a \\ 2 & = d \end{array}$$

$d = 2\overline{)36}$
$\quad\;\; \overline{18}$

5. One travelled 50 *Miles*, encreasing his Journey every Day 2 *Miles*, till at 5 *Days* end he finished it. How many Miles did he travel every Day?

$s = 50$
$d = 2$
$n = 5$

Then $na + nu = 2s$
$\because na = 2s - nu$
$\because a = \dfrac{2s - nu}{n}$

Again $\dfrac{u-a}{n-1} = d$

$\because u - a = nd - d$
$\because u = nd - d + a$
$\because a = u - nd + d$

Then $\dfrac{2s - nu}{n} = u + d - nd$

$\because 2s - nu = nu - + nd - nnd$
$\because 2s = nd - nnd + 2nu$
$\because 2nu = 2s + nnd - nd$
$\because u = \dfrac{2s + nnd - nd}{2} = 14$

$$\begin{array}{r l} 100 & = 2s \\ 50 & = nnd \\ \hline 150 & \\ 10 & = nd \\ \hline 10)140(14 & \\ \hline 0 & \end{array}$$

One

6. One had 40 *Cloths*, worth 5*l.* each. He ſold the *firſt* for 1 *Crown*, and increaſed his Piece 2 *Crowns* more for every *Cloth*, than was paid for the former. What did he receive for his *Cloths*, and how much did he gain by them?

$n=40$ Then $nd-d=u-a$ $a=1$
$a=1$ $\because a+nd-d=u=79$ $nd=80$
$d=2$ Again $na+nu=2s$ 81
$\because s=\dfrac{na+nu}{2}=1600$ $d=2$
79

$40=na$ 400 $79=u$
$3160=nu$ 200 $40=n$
$2|3200$ £. 200 *gained* $3160=nu$
$4|1600$ *Crowns*
400£.

7. A Sum of Money is to be paid in 12 *Days*, paying the *firſt* Day 10 *l.* and increaſing every Payment after 5 *l.* till the *Days* are expired. What is the Debt?

$n=12$ Then $a+nd-d=u=65$ $a=10$
$d=5$ And $s=\dfrac{na+nu}{2}=450$ $nd=60$
$a=10$ 70
$d=5$
65

$120=na$ $65=u$
$780=nu$ $12=n$
$2|900$ $780=nu$
450

8. 685*l.* is to be diſburſed by *Arithmetical Progreſſion*, to how many I know not; but the *firſt* had 19*l.* and the *laſt* 118*l.* How many did receive the Money, and how much had each?

 $s=685$

$s = 685$ Then $na + nu = 2s$
$a = 19$ $\therefore n = \frac{2s}{a+u} = 10$
$u = 118$

$$\begin{array}{r} 118 = u \\ 19 = a \\ \hline n-1 = 9)99(11 \\ 0 \end{array} \qquad \begin{array}{r} 685 = s \\ 2 \\ \hline 137)1370(10 \\ 0 \end{array}$$

Again $d = 11 = \frac{u-a}{n-1}$

$$\begin{array}{r} 118 = u \\ 19 = a \\ \hline 137 = a+u \end{array}$$

1	19
2	30
3	41
4	52
5	63
6	74
7	85
8	96
9	107
10	118
	685

Geometrical Progression,

IS when any *Rank*, or *Series* of Numbers, do increase by one *common Multiplier*, or decrease by one *common Divisor*, called the *Ratio*.

As 2, 4, 8, 16, &c. here 2 is the *common Multiplier*. Or 128, 64, 32, 16, &c. here 2 is the *common Divisor*.

Again, 2, 6, 18, 54, &c. here 3 is the *common Multiplier*. Or 128, 32, 8, 2. here 4 is the *common Divisor*.

1. If *three* Numbers are *proportional*, the *Product* of the *Extremes* will be *equal* to the *Square* of the *Mean*.

$$2 : 4 : 8 \qquad 16 : 8 : 128 : 32 : 8$$

$$\begin{array}{r} 4 \\ \hline 16 \end{array} = \begin{array}{r} 2 \\ \hline 16 \end{array} \qquad \begin{array}{r} 4 \\ \hline 64 \end{array} = \begin{array}{r} 8 \\ \hline 64 \end{array} \qquad \begin{array}{r} 128 \\ 8 \\ \hline 1024 \end{array} \qquad \begin{array}{r} 32 \\ 32 \\ \hline 64 \\ 96 \\ \hline 1024 \end{array}$$

2. If

2. If *four* Numbers are *proportional*, the *Product* of the *Extremes* will be *equal* to the *Product* of the *Means*.

2 : 4 : 8 : 16		32 : 16 : 8 : 4		128 : 32 : 8 : 2	
8	2	4	8	2	8
32 =	32	128 =	128	256 =	256

From hence it follows, that if never so many Numbers be in *continual Proportion*, the *Product* of the *two Extremes* will be *equal* to the *Product* of any *two Means*, *equally* distant from the *Extremes*.

3. If never so many Numbers are *proportional*, it will be, as any one of the *Antecedents* is to its *Consequent*; so will the *Sum* of all the *Antecedents* be, to the *Sum* of all the *Consequents*.

Note, all the Terms except the *last*, are *Antecedents*; and all the Terms except the *first*, are *Consequents*.

2 : 4 : 8 : 16 : 32 : 64 : 128 : 256

8	64
16	32
32	16
64	8
128	4
256	2
Sum 508 *Consequents*	*Sum* 254 *Antecedents*

As 2 . . 4 :: 254 . . 508		As 32 . . 64 :: 254 . . 508	
4	2	64	32
1016 =	1016	1016	1016
		1524	1524
		16256 =	16256

These

These Things being premised, such *Equations* may be deduced, as will solve all such *Questions*, as are usually proposed about *Quantities* in *Geometrical Proportion*, continued.

Let the *first* Term be = to - - - - - - - - - - a
The *common* Ratio - - - - - - - - - - - - - - - - - r
The *last* Term - - - - - - - - - - - - - - - - - - - u
The *Sum* of all the Terms - - - - - - - - - - - s

$$\text{As } a \,..\, ar :: \frac{s-u}{ar} \,..\, \frac{s-a}{a}$$

$$\text{Then } ars - aru = as - aa$$

$$\therefore rs - ru = s - a$$

To find the *last Term* of any *Geometrical Series* of Numbers.

If the *first* Term of any *Geometrical Series* be an *Unit*; then the *first* Term of the *Arithmetical Series* must be a *Cypher*.

If the *first* Term of any *Geometrical Series* be *more* than an *Unit*, then the *first* Term of the *Arithmetical* must be an *Unit*.

1.	Arithmetical Terms	0 :	1 :	2 :	3 :	4 :	5 :	6
	Geometrical Terms	1 :	2 :	4 :	8 :	16 :	32 :	64
2.	Arithmetical Terms	1 :	2 :	3 :	4 :	5 :	6 :	7
	Geometrical Terms	3 :	9 :	27 :	81 :	243 :	729 :	2187

The *Product* of any *two Geometrical Terms*, gives that *Geometrical Term*, which is the *Sum* of the *two Arithmetical Terms* over them.

Thus, in the *first* Case, $16 \times 4 =$ to 64, the *Sum* of 4 and 2, *viz.* the 6th *Term.*

Again, in the *second* Case, $81 \times 9 = 729$, the 6th *Term.*

Now, 6th *Term multiplied* by the 4th, will produce the 10th, and the 10th *multiplied* by the 10th will produce the 20th, &c. And therefore, from hence

hence it is plain, that any Term in a *Geometrical Series*, by the Help of some of the beginning Terms, may be produced, without shewing all the Terms.

1. One bought an *Horse* after this Manner. The *Horse* had 4 *Shoes*, every *Shoe* contained 6 *Nails*, in all 24. He thinking to have a good Bargain, agreed to pay a *Farthing* for the *first* Nail, and *double* it to the *last*. What did he pay for the *Horse*?

$a = 1$
$r = 2$

Arithmetic Terms	0 : 1 : 2 : 3 : 4 : 5 : 6
Geometrical Terms	1 : 2 : 4 : 8 : 16 : 32 : 64

6th Term - - - - 64
6th Term - - - - 64
256
384
12th Term - 4096
6th Term - - 64
16384
24576
18th - - 262144
5th - - - - - - 32
524288
786432
23d - - 8388608 $= u$

Then $rs - ru = s - a$

∴ $rs - s - ru = -a$

∴ $rs - s = ru - a$

∴ $s = \dfrac{ru - a}{r - u}$

$8388608 = u$
$2 = r$
$16777216 = ru$
$1 = a$
$4 | 16777215 = s$
$12 | 4194303 : \frac{3}{4}$
$20 | 34952 | 5 : 3$

The Price of the Horse - - - - £.17476 : 5 : $3\frac{3}{4}$
s. *d.*

2. A cunning *Servant* agreed with his *Master*, unskilled in Numbers, to serve him 11 *Years*, without any other Reward for his Service, but the Produc

Produce of a *Wheat Corn*, and that Product to be sowed the *next Year*, and so on, from Year to Year, until the End of the *Time*, taking the Increase, but in a *ten-fold Proportion*. It is required, to find the Sum of the whole Produce?

Note, 7680 *Corns*, contain a Statute Pint, and let the *Wheat* be rated at 16 *s. per Quarter*.

Arith.	1	2	3	4	5	6
Geo.	10 :	100 :	1000 :	10000 :	100000 :	1000000

6th Term 1000000 Then $s = \frac{ru - a}{r - s}$ $a = 10$

5th Term 100000 $r = 10$

11th Term 100000000000 $= u$

10 $= r$

1000000000000 $= ru$

10 $= a$

$r - 1 = 9$ | 999999999990 *Pints*

7680 | 111111111110 $= s$, | 14467592

4 | 7233796 *qts.*

2 | 1808449 *gall.*

4 | 904224 : 1 *pecks*

8 | 226056 *bush.*

28257 *qrs.*

qua.
28257 at 16*s. per Quarter* is 22605 £. 12*s.*

3. When *Sessa Ebn Dahir*, an *Indian*, presented the Play of the *Chess-board* to King *Scheramus*, he did so admire the Excellence of the Invention, that he bid *Dahir* ask whatever he pleased, and it should be granted him. He asked no other Gift, but a *Grain* of *Wheat* for the first *Square*, and that it might be *doubled*, as often as there were *Squares* on the Board, which was 64.

The

The King being greatly displeased at his asking so small a Reward, commanded his Servants to give him just that Number and not *one Grain* more; which, when his *Secretary* had computed, they brought him Word that there was not to be found on the whole Earth, much less in his Kingdom, a Quantity of Wheat equal to that Sum.

When the King heard this, he was as much pleased with the Ingenuity of the *Petition*, as he was before with that of the *Invention*.

How many *Tons* of Wheat were there, and how much would it amount to at 5 *l.* *per Ton*; and how many such Ships as our *Royal Sovereign* of 1000 *Tons*, would be loaden therewith?

$$\begin{array}{lccccccc} \text{Arithmetic} & 0 : & 1 : & 2 : & 3 : & 4 : & 5 : & 6 \\ \text{Geometric} & 1 : & 2 : & 4 : & 8 : & 16 : & 32 : & 64 \end{array}$$

$a = 1$

$r = 2$

Then $s = \dfrac{ru - a}{r - 1}$

$$\begin{array}{rr}
4 \text{ - - } & 16 \\
4 \text{ - - } & 16 \\
\hline
8 \text{ - } & 256 \\
8 \text{ - } & 256 \\
\hline
16 \text{ - - - } & 65536 \\
16 \text{ - - - } & 65536 \\
\hline
32 \text{ - - - } & 4294967296 \\
16 \text{ - - - - - - - } & 65536 \\
\hline
48 \text{ - } & 281474976710656 \\
12 \text{ - - - - - - - - } & 4096 \\
\hline
60 \text{ - } & 1152921504606846976 \\
3 \text{ - - - - - - - - - - - - } & 8 \\
\hline
63 \text{ - } & 9223372036854775808 = u \\
 & 2 = r \\
\hline
 & 18446744073709551616 = ru \\
 & 1 = a \\
\hline
r - 1 = 1 | & 18446744073709551615
\end{array}$$

7680)18446744073709551615 Grains.

2)240191980126426 4 Pints.

4)120095990063213 2 Quarts.

2)30023997515803 3 Gallons.

4)1501199875790 16 : 1 Pecks

8)37529996894754 Bushels.

4)4691249611844 : 2 Quarters.

1172812402961 Tons.

Ton. *Q.* *B.* *P.* *G.*

1172812402961 : 0 : 2 : 0 : 1 at 5 *l.* *per Ton*, is 5864062014805 *l.* 6 *s.* 4 *d.*

1000)1172812402961(

1172812402 Ships.

INTEREST.

LET the *Principal*, or Sum put out to Interest, be $=p$.

The *Ratio* of the Rate *per Cent. per Ann.* be $=r$.
The *Time* of Continuance at Interest be $=t$.
The *Amount* of the Principal and Interest be $=a$.

Note: The *Ratio* of the Rate is only the *Simple Interest* of 1 *l.* for one Year, and is thus found.

As 100 : .6 :: 1 : .06. As 100 : 5 :: .05
As 100 : 7.5 :: 1 : .075. As 100 : 7.75 :: 1 : .0775

Theorem.

$$trp+p=a$$

1. At

1. At 5 *per Cent. per Ann.* what is the *Amount* of 279 *l.* 15 *s.* 8 *d.* forborn 13 *Years?*

Then $trp + p = a$

$r = .05$
$t = 13$
$p = 279.783333$

$p = 279.783333$
$r = .05$
$pr = 13.98916665$
$t = 13$
$prt = 181.85916645$
$p = 279.78333333$
$a = £.\ 461.64249978$
20
Sh. 12.84999560
12
d. 10.19994720

15 : 8
12
188
240)188.000000
.783333

2. At 6 *per Cent. per Ann.* what will 354 *l.* 14 *s.* 7 *d. amount* to in 7 *Years,* 25 *Days?*

Then $trp + p = a$

$r = .06$
$p = 354.729166$
$t = 7.068493$

25
365)25.000000
.068493

s. *d.*
14 : 7
12
175
240)175.000000
.729166

$p = 354.729166$
$r = .06$
$pr = 21.28374996$
$t = 7.068493$
$prt = 150.44403760601028$
$p = 354.7291666$
$a = £.\ 505.1732042$
20
Sh. 3.4640840
12
d. 5.5690080
4
f. 2.276

3. What is 728 *l.* 16 *s.* 8 *d.* payable at the End of $5\frac{1}{2}$ *Years*, worth in *ready Money*, at 5 *per Cent. Discount?*

Then $trp+p=a$ $\qquad t=5.5$

$\because p=\dfrac{a}{tr+1}$ $\qquad r=.05$

$r=.05$ $\qquad tr\ .275$

$t=5.5$ $\qquad 1.$

$a=728.833333$ $\qquad 1.275$

$tr+1=1.275)728.83333333=a$

16 : 8 $\qquad p=571.63398$

12 $\qquad 20$

200 $\qquad 12.67960$

240)200.000000 $\qquad 12$

.833333 $\qquad 8.15520$

4. At what Rate *per Cent.* will 256 *l.* 10 *s.* *amount* to 309 *l.* 16 *s.* 10 *d.* in 3 *Years*, 1 *Quarter*, 2 *Months*, 18 *Days?*

Then $trp+p=a$

$p=256.5$ $\qquad \because trp=a-p$

$a=309.841666$ $\qquad \because r=\dfrac{a-p}{tp}$

$t=3.465981$

16 : 10

$$\begin{array}{l} 16 : 10 \\ \underline{12} \\ \underline{202} \\ 240)202.000000 \\ \quad .841666 \end{array}$$

$$\begin{array}{lr} \text{1 Quarter} & .25 \\ \text{2 Months} & .166666 \\ \text{18 Days} & \underline{.049315} \\ & t = 3.465981 \\ & \underline{p = 256.5} \\ & 17329905 \\ & 20795886 \\ & 17329905 \\ & \underline{6931962} \\ & tp = 889.0241265 \end{array}$$

$$\begin{array}{r} a = 309.841666 \\ \underline{p = 256.5} \\ a - p = 53.341666 \end{array}$$

$$889.0241265)53.341666666$$
$$r = .06$$

5. In what Time will 350 *l.* raiſe a Stock of 400 *l.* at $6\frac{1}{2}$ *per Cent. per Annum?*

$a = 400$
$p = 350$
$r = .065$

Then $trp + p = a$

$\therefore trp = a - p$

$\therefore t = \dfrac{a-p}{rp}$

$\therefore trp = a - p$

$$\begin{array}{r} a = 400 \\ \underline{p = 350} \\ a - p = 50 \end{array}$$

$$\begin{array}{r} p = 350 \\ \underline{r = .065} \\ 1750 \\ \underline{2100} \\ rp = 22.750)50.0000000 \\ \text{Years } 2.1978 \\ \underline{365} \\ \text{Days } 72.1970 \end{array}$$

To compute *Annuities* or *Pensions* in Arrear.

Let the *yearly Rent* of an Annuity or Pension be $=y$.

The *Time* of its Continuance, or being unpaid, $=t$.

The *Ratio*, or Interest of 1 *l.* one Year, be $=r$.

The *Amount* of the Annuity, with its Interest, $=a$.

$$\text{Now } \frac{ttr - tr}{2} = \frac{a - ty}{y}$$

1. If 250 *l. yearly Rent*, be forborn or unpaid 7 *Years*, what will it *amount* to, at 6 *per Cent.* for each Payment, as it becomes due?

$y = 250$
$t = 7$
$r = .06$

$$\text{Then } \frac{ttr - tr}{2} = \frac{a - ty}{y}$$

$$\therefore ttry - try = 2a - 2ty$$

$$\therefore ttry - try + 2ty = 2a$$

$$\therefore a = \frac{ttry - try + 2ty}{2} = 2065\ £.$$

$7 = t$
$7 = t$

$49 = tt$	$7 = t$	$14 = 2t$	$735 = ttry$
$.06 = r$	$.06 = r$	$250 = y$	$3500 = 2ty$
$2.94 = ttr$	$.42 = tr$	700	4235
$250 = y$	$250 = y$	28	105
14700	2100	$3500 = 2ty$	2)4130
588	84		2065
$735.00 = ttry$	$105.00 = try$		

2. What *yearly Rent*, forborn 9 *Years*, will raise a Stock of 3000 *l.* allowing $5\frac{1}{4}$ *per Cent?*

$t = 9$
$a = 3000$
$r = .0525$

$$\text{Then } \frac{ttr - tr}{2} = \frac{a - ty}{y}$$

$$\therefore ttry - try = 2a - 2ty$$

$$\therefore ttry - try + 2ty = 2a$$

$$\therefore y = \frac{2a}{ttr - tr + 2t} = 275.482$$

$.0525=r$	$.0525=r$	$9=t$	$3000=a$
$81=tt$	$9=t$	2	2
$4.2525=ttr$	$.4725=tr$	$18=2t$	$6000=2a$
$.4725=tr$			
3.7800			
$18.=2t$			

$$21.7800)6000.0000000$$

$$£.\ 275.482$$
$$20$$
$$Sh.\ 9.640$$
$$12$$
$$d.\ 7.680$$
$$4$$
$$f.\ 2.720$$

If 250 *l. yearly Rent*, forborn 7 *Years*, amounts to 2065 *l.* what must the *Rate* of Interest be *per Cent?*

$y=250$
$t=7$
$a=2065$

Then $\frac{ttr-tr}{2}=\frac{a-ty}{y}$

$\therefore ttry-try=2a-2ty$

$\therefore r=\frac{2a-2ty}{tty-ty}=.06$

$2065=a$	$250=y$	$250=y$	$250=y$
2	$7=t$	$14=2t$	$49=tt$
$4130=2a$	$1750=ty$	$3500=2ty$	$12250=tty$
$3500=2ty$			$1750=ty$
			10500

$$10500)630.00$$
$$.06$$
$$100$$
$$6.00$$

a 1 — —— 3 B— 1.46

The present Worth of *Annuities*, *Pensions*, *&c.* may be computed by the following *Equation.*

$$\frac{ttry - try + 2ty}{2} = ptr + p$$

1. What is 59 *l. yearly Rent*, to continue 5 *Years*, worth in *ready Money*, at 6 *per Cent. per Annum*?

$y = 59$
$t = 5$
$r = .06$

Then $\frac{ttry - try + 2ty}{2} = ptr + p$

$\therefore ttry - try + 2ty = 2ptr + 2p$

$\therefore p = \frac{ttry - try + 2ty}{2tr + 2} = 254.1538$

$25 = tt$	$.06 = r$	$59 = y$	$10 = 2t$
$.06 = r$	$5 = t$	$10 = 2t$	$.06 = r$
$1.50 = ttr$	$.30 = tr$	$590 = 2ty$	$.60 = 2tr$
$59 = y$	$59 = y$		$2.$
$88.50 = ttry$	$17.70 = try$		2.60
$17.70 = try$			
70.80			
$590 = 2ty$			

2.60)660.800000

£. 254.1538
20

Sh. 3.0760
12

d. .9120
4

f. 3.6480

2. What

2. What *Annuity* may be purchased for 60 *l.* to continue 21 *Years*, at 6 *per Cent. per Annum.*

$p=60$
$t=21$
$r=.06$

Then $\dfrac{ttry-try+2ty}{2}=ptr+p$

$\therefore ttry-try+2ty=2ptr+2p$

$\therefore y=\dfrac{2ptr+2p}{ttr-tr+2t}=4.0357$

$$\begin{array}{r}
60=p\\
2\\
\hline
120=2p\\
21=t\\
\hline
2520=2pt\\
.06=r\\
\hline
151.20=2ptr\\
120=2p\\
\hline
67.20|271.200000\\
\hline
£.\ 4.0357\\
20\\
\hline
.7140\\
12\\
\hline
d.\ 8.5680\\
4\\
\hline
far.\ 2.2720
\end{array}
\qquad
\begin{array}{r}
60=p\\
2\\
\hline
120=2p
\end{array}
\qquad
\begin{array}{r}
21=t\\
21=t\\
\hline
441=tt\\
.06=r\\
\hline
26.46=ttr\\
1.26\\
\hline
25.20\\
42=2t\\
\hline
67.20
\end{array}
\qquad
\begin{array}{r}
21=t\\
.06=r\\
\hline
1.26=tr
\end{array}$$

QUADRATIC

Quadratic Equations.

THERE are *three* Cases, or Forms of *Quadratic Equations*.

1 Case $xx = ax + bb$

$\therefore\ xx - ax = bb$

Note, In the *Equation*, $xx - ax = bb$, a, is called the *Coeficient*; and the *Square* of $\frac{1}{2}$ the *Coeficient* added to $xx - ax$, makes it a *compleat Square*; and therefore must be added to both Sides of the *Equation*,

Then $xx - ax = bb$

$$\therefore\ xx - ax + \frac{aa}{4} = \frac{aa}{4} + bb$$

$$\therefore\ x - \frac{a}{2} + \sqrt[2]{\frac{aa}{4} + bb}$$

$$\therefore\ x = \frac{a}{2} + \sqrt[2]{\frac{aa}{4} + bb}$$

Proof.

$$x - \frac{a}{2} \text{ is } \frac{\dfrac{2x-a}{2} \times \dfrac{2x-a}{2}}{4} \quad \frac{4xx - 4ax + aa}{}$$

$$\begin{array}{l} 2x - a \\ 2x - a \\ \hline 4xx - 2ax \\ \quad - 2ax + aa \\ \hline 4xx - 4ax + aa \end{array}$$

Then $\frac{4xx - 4ax + aa}{4}$ is $xx - ax + \frac{aa}{4}$

Now $xx - ax + \frac{aa}{4} = \frac{aa}{4} + bb$

$\therefore\ xx - ax = bb$

$\therefore\ xx = ax + bb$. Which was to be proved.

2 : Case $xx = -ax + bb$

$\therefore xx + ax = bb$

By adding the *Square* of $\frac{1}{2}$ the *Coeficient* to each Side of the *Equation*, it will be

$$xx + ax + \frac{aa}{4} = \frac{aa}{4} + bb$$

$$\therefore x + a \sqrt[2]{\frac{aa}{4} + bb}$$

$$\therefore x = \sqrt[2]{\frac{aa}{4} + bb} - \frac{a}{2}$$

Or thus, $x = -\frac{a}{2} + \sqrt[2]{\frac{aa}{4} + bb}$

3 : Case $xx = ax - bb$

$\therefore xx - ax = -bb$

By adding the *Square* of $\frac{1}{2}$ the *Coeficient* as afore, it will be

$$xx - ax + \frac{aa}{4} = \frac{aa}{4} - bb$$

$$\therefore x - \frac{a}{b} \sqrt[2]{\frac{aa}{4} - bb}$$

$$\therefore x = \frac{a}{2} + \sqrt[2]{\frac{aa}{4} - bb}$$

Or $x = \frac{a}{2} - \sqrt[2]{\frac{aa}{4} - bb}$

Note, This Case having *two Roots*, Use and Practice will teach us, which of them is to be applied in any *Question* proposed. But often, both of them will be useful in the Construction.

1. To find a *Number*, which being multiplied by 6; and the *Product* subtracted from the *Square* of the said *Number*, shall leave 280.

Numerically.

x, the Number sought.

Then $xx - 6x = 280$

$\therefore\ xx - 6x + 9 = 289$

$\therefore\ x - 3 = \sqrt[2]{289}$

$$\begin{array}{r|l} \sqrt[2]{289} & 17 \\ 1 & 3 \\ \hline 27\,|\,189 & 20 \\ 189 & \\ \hline 0 & \end{array}$$

$$\therefore\ x = 3 + \sqrt[2]{289} = 20$$

$$\begin{array}{r} 20 \\ 20 \\ \hline 400 \end{array} \qquad \begin{array}{r} 20 \\ 6 \\ \hline 120 \end{array} \qquad \begin{array}{r} 400 \\ 120 \\ \hline 280 \end{array}$$

Literally.

Let $6 = a$ Then $xx - ax = b$

$280 = b$ $\therefore\ xx - ax + \frac{aa}{4} = \frac{aa}{4} + b$

$4\,|\,\frac{36}{9} = aa$ $\therefore\ x - \frac{a}{2} = \sqrt[2]{\frac{aa}{4} + b}$

$\overline{280} = b$

$\sqrt[2]{289}\,|\,17$ $\therefore\ x = \frac{a}{2} + \sqrt[2]{\frac{aa}{4} + b} = 20$

$$\begin{array}{rl} 0 & 3 \\ & 20 \end{array}$$

2. To find a *Number*, which being multiplied by 8, and the *Product* added to the *Square* of the *Number* sought shall produce 660.

Numeri-

Numerically.

x, The Number sought.
Then $xx+8x=660$
$\therefore\ xx+8x+16=676$
$\therefore\ x+4=\sqrt[2]{676}$
$\therefore\ x=-4+\sqrt[2]{676}=22$

$$\begin{array}{r} \sqrt[2]{\dot{6}7\dot{6}}\,|\,26 \\ \underline{4}\quad \underline{4} \\ 46\,|\,276\quad 22 \\ \underline{276} \\ 0 \end{array}$$

$$\begin{array}{r} 22 \\ \underline{22} \\ 44 \\ \underline{44} \\ 484 \end{array} \qquad \begin{array}{r} 22 \\ \underline{8} \\ 176 \end{array} \qquad \begin{array}{r} 484 \\ \underline{176} \\ 660 \end{array}$$

Literally.

Let $8=a$ Then $xx+ax=b$
$660=b$

$\therefore\ xx+ax+\frac{aa}{4}=\frac{aa}{4}+b$

$\therefore\ x+\frac{a}{2}+\sqrt[2]{aa+b}$

$\therefore\ x=-\frac{a}{2}+\sqrt[2]{\frac{aa}{4}+b}=22$

$$\begin{array}{r} 4|64=aa \\ \underline{\quad} \\ 16 \\ 660=b \\ \sqrt[2]{676}\,|\,26 \\ \underline{4} \\ 225 \end{array}$$

3. Let 969 *Soldiers*, be drawn up into an *oblong* Square; so that the Difference between the *greater* and *lesser* Sides be 40. I demand the Number of *Soldiers* in each Rank, *Length* and *Breadth*?

Numerically.

x, the Number of Soldiers in the Length.
$x+40$, the Number in Breadth.

$$\begin{array}{l} x \\ \hline xx+40x \end{array} \qquad \text{Then } xx+40x=969$$

$$\therefore xx+40x+400=1369$$

$$\therefore x+20=\sqrt[2]{1369}$$

$$\therefore x=-20+\sqrt[2]{1369}=17$$

$$\begin{array}{rll} & \sqrt[2]{1369}(37 & \\ & \underline{9} & \underline{20} \\ 67 & 496 & 17 \\ & \underline{469} & \\ & 0 & \end{array}$$

Length 17 Breadth 57

$$\begin{array}{r} 57 \\ \underline{17} \\ 399 \\ \underline{57} \\ 969 \end{array}$$

Literally.

Let $969=a$ Then $xx+bx=a$
$40=b$

$$\therefore xx+bx+\frac{bb}{4}=\frac{bb}{4}+a$$

$$\begin{array}{r} 40=b \\ \underline{40=b} \\ 4)1600=bb \\ \hline 400 \\ \underline{969=a} \\ \sqrt[2]{1369}(17 \end{array}$$

$$\therefore x+\frac{b}{2}=\sqrt[2]{\frac{bb}{4}+a}$$

$$\therefore x=-\frac{b}{2}+\sqrt[2]{\frac{bb}{4}+a}=17$$

4. Let 480 *Soldiers*, be drawn up, into an *oblong* Square; so that the Sum of the *greater* and *lesser* Sides be 52. I demand the Number of each Rank, in *Length* and *Breadth?*

Numeri-

Numerically.

x, the Number of Soldiers in Length.

$52-x$, the Number in Breadth.

$$\begin{array}{l} x \\ \hline 52x-xx \end{array}$$

Then $52x-xx=480$

$\therefore xx-52x=-480$

$\therefore xx-52x+676=196$

$\therefore x-26=\sqrt{196}$

$\therefore x=26+\sqrt{196}=40$

$$\sqrt{196}|14$$

$$\begin{array}{rr} 1 & 26 \\ \hline 24|96 & 40 \\ 96 & \\ \hline 0 & \end{array}$$

Length 40 Breadth 12

$$\begin{array}{r} 12 \\ \hline 480 \end{array}$$

Literally.

Let $480=a$

$52=b$

Then $bx-xx=a$

$\therefore xx-bx=-a$

$\therefore xx-bx+\frac{bb}{4}=\frac{bb}{4}-a$

$\therefore x-\frac{b}{2}=\sqrt{\frac{bb}{4}-a}$

$\therefore x=\frac{b}{2}+\sqrt{\frac{bb}{4}-a}=40$

$$\begin{array}{r} 52=b \\ 52=b \\ \hline 104 \\ 260 \\ \hline 4|2704=bb \\ \hline 676 \\ 480=a \\ \hline \sqrt{196}|14 \\ 26 \\ \hline 40 \end{array}$$

5. A Man buys some *Ells* of Cloth for 70 *Crowns*, and finds, that if he had had 4 *Ells* more, he had

had bought every *Ell* 2 *Crowns* cheaper. How many *Ells* did he buy?

Numerically.

x, the Number of Ells bought.

As $x : 70 :: 1 : \frac{70}{x}$ the Price of an *Ell.*

$$\text{As } x+4 : 70 :: 1 : \frac{70}{x+4}$$

$$\frac{70}{x+4}+2, \text{ is } \frac{70+2x+8}{x+4}.$$

$$\text{Then } \frac{70+2x+8}{x+4} = \frac{70}{x}$$

$$\therefore 70x+2xx+8x = 70x+280$$
$$\therefore 78x+2xx = 70x+280$$
$$\therefore 8x+2xx = 280$$
$$\therefore xx+4x = 140$$
$$\therefore xx+4x+4 = 144$$
$$\therefore x+2 = \sqrt[2]{144}$$
$$\therefore x = -2+\sqrt[2]{144} = 10$$

As $10 : 70 :: 1 : 7$
As $14 : 70 :: 1 : 5$

Literally.

Let $70 = a$, $4 = b$, $2 = c$

as $x : a :: 1 : \frac{a}{x}$

as $x+b : a :: 1 : \frac{a}{x+b}$

$\frac{a}{x+b}+c$, is $\frac{a+cx+bc}{x+b}$

Then

Then $\dfrac{a+cx+bc}{x+b}=\dfrac{a}{x}$

$\because\ ax+cxx+bcx=ax+ab$

$\because\ cxx+bcx=ab$

$\therefore\ xx+bx=\dfrac{ab}{c}$

$\because\ xx+bx+\dfrac{bb}{4}=\dfrac{bb}{4}+\dfrac{ab}{c}$

$\because\ x+\dfrac{b}{2}=\sqrt[2]{\dfrac{bb}{4}+\dfrac{ab}{c}}$

$\because\ x=-\dfrac{b}{2}+\sqrt[2]{\dfrac{bb}{4}+\dfrac{ab}{c}}=10$

$4|16=bb$, 4

$70=a$
$4=b$
$c=2|280=ab$
140

140
4
$\sqrt[2]{144}|12$
2
10

6. A Sett of Boon Companions, dining at an Inn. The Reckoning came to 175 *Pence*; but before the Bill was paid, *two* of them slipt away, and then the club of them that remained, came to 10 *Pence per* Man more. How many were there in Company?

Numerically.

x, the Number of Companions.

$\dfrac{175}{x}$ Each Man's Reckoning.

$\dfrac{17b}{x-2}$ Each Man's Reckoning left behind.

Then

Then $\frac{175}{x} + 10$, is $\frac{175+10x}{x} = \frac{175}{x-2}$

$\therefore 175x + 10xx - 350 - 20x = 175x$

$\therefore 10xx - 350 - 20x = 0$

$\therefore 10xx - 20x = 350$ $\qquad 7|175$ / 25

$\therefore xx - 2x = 35$

$\therefore xx - 2x + 1 = 36$

$\therefore x - 1 = \sqrt[2]{36}$ $\qquad 5|175$ / 35

$\therefore x = 1 + \sqrt[2]{36} = 7$ $\qquad 25 + 10 = 35$

Literally.

Let $175 = a$, $2 = b$, $10 = c$. Then $\frac{a}{x} + c$, is $\frac{a+cx}{x} = \frac{a}{x-b}$

$175 = a$, $2 = b$, $c = 10|\overline{350}\ ab$, 35

$\therefore ax + cxx - ab - bcx = ax$

$\therefore cxx - ab - bcx = 0$

$\therefore cxx - bcx = ab$

$\therefore xx - bx = \frac{ab}{c}$

$\sqrt[2]{36}|6$, $\frac{1}{7}$

$\therefore xx - bx + \frac{bb}{4} = \frac{bb}{4} + \frac{ab}{c}$ $\qquad 2 = b$, $2 = b$, $4|4 = bb$, 1

$\therefore x - \frac{b}{2} = \sqrt[2]{\frac{bb}{4} + \frac{ab}{c}}$

$\therefore x = \frac{b}{2} + \sqrt[2]{\frac{bb}{4} + \frac{ab}{c}} = 7$

7. To divide the Number 21, into *two Parts*; ſo that if the *greater* be divided by the *leſſer*; and again, the *leſſer* by the *greater*; and then the *firſt* Quotient if multiplied by 4, and the *ſecond* by 25, the *Products* may be *equal.*

Numeri-

Numerically.

$[x \quad]\ 21-x$ $\qquad \begin{array}{c} 4x \\ \hline \frac{x}{21-x}\times\frac{4}{1} \\ \hline 21-x \end{array} \qquad \begin{array}{c} 525-25x \\ \hline \frac{x}{21-x}\times\frac{25}{1} \\ \hline x \end{array}$

Then $\frac{4x}{21-x}=\frac{525-25x}{x}$

$\therefore 4xx=11025-525x-525x+25xx$

$\therefore 4xx=11025-1050x+25xx$ $\qquad 21)1050(50$

$\qquad\qquad 0$

$\therefore 25xx-1050x=4xx-11025$

$\therefore 21xx-1050x=-11025$ $\qquad 21)11025(525$

$\qquad\qquad 52$

$\qquad\qquad 105$

$\qquad\qquad 0$

$\therefore xx-50x=-525$

$\therefore xx-50x+625=100$

$\therefore x-25=\sqrt[2]{100}$

$\therefore x=25+\sqrt[2]{100}=35$, too great.

$\therefore x=25-\sqrt[2]{100}=15$

$[15 \quad]\ 6$ $\qquad \begin{array}{c} 60 \\ \hline \frac{15}{6}\times\frac{4}{1} \\ \hline \end{array} \qquad \begin{array}{c} 150 \\ \hline \frac{6}{15}\times\frac{25}{1} \\ \hline \end{array}$

$6)60(10 \qquad 15)150(10$

$\quad 0 \qquad\qquad 0$

Literally.

Let $21=a$ $\quad [x \quad]\ a-x$

$4=b$

$25=c$

$\begin{array}{c} ca-cx \\ \hline \frac{a-x}{x}\times\frac{c}{1} \\ \hline x \end{array} \qquad \begin{array}{c} bx \\ \hline \frac{x}{a-x}\times\frac{b}{1} \\ \hline a-x \end{array}$

T t Then

Then $\frac{ca-cx}{x}=\frac{bx}{a-x}$

$\therefore caa-cax-cax+cxx=bxx$

$\therefore caa-2cax+cxx=bxx$

$\therefore cxx-2cax=bxx-caa$

$\therefore cxx-bxx-2cax=-caa$. Let $c-b=d=21$

$\therefore dxx-2cax=-caa$

$$\therefore xx-\frac{2cax}{d}=-\frac{caa}{d}$$

$$\therefore xx-\frac{2cax}{d}+\frac{4ccaa}{4dd}=\frac{4ccaa}{4dd}-\frac{caa}{d}$$

$$\therefore x-\frac{2ca}{2d}=\sqrt[2]{\frac{4ccaa}{4dd}-\frac{caa}{d}}$$

$$\therefore x=\frac{2ca}{2d}-\sqrt[2]{\frac{4ccaa}{4dd}-\frac{caa}{d}}=15$$

25 = c
25 = c
125
50
625 = cc
4
2500 = 4cc

21 = a
21 = a
21
42
441 = aa
2500 = 4cc
220500
882
4dd = 1764) 1102500 (625
4410
8820
0

$\sqrt[2]{}$ 525
100 (10
25
15

441 = dd
4
1764 = 4dd

441 = aa
25 = c
2205
882
d = 21) 11025 (525
52
105
0

25 = c
21 = a
25
50
525 = ca
2
2d = 42) 1050 (25
210
0

8. Let 600 *Soldiers* be diſpoſed into an *oblong* Square, which the *Colonel*, willing to make *broader*, finds that if he takes away 10 *Ranks* from the *Length*, he ſhall increaſe the *Breadth* with 2 *Ranks*. What was the *Number* of his *Soldiers* in *Length* and *Breadth*?

Numerically.

x, the Number of Soldiers in Length.

$\frac{600}{x}$ the Number in Breadth.

$$\text{Then } \frac{600}{x}+2, \text{ is } \frac{\overline{600x+2xx-6000-20x}}{\frac{\frac{600+2x}{x}\times\frac{x-10}{1}}{x}}$$

$$\therefore \frac{600x+2xx-6000-20x}{x}=600$$

$$\therefore 600x+2xx-6000-20x=600x$$

$$\therefore 2xx-6000-20x=0$$

$$\therefore 2xx-20x=6000$$

$$\therefore xx-10x=3000$$

$$\therefore xx-10x+25=3025$$

$$\therefore x-5=\sqrt[2]{3025}$$

$$\therefore x=5+\sqrt[2]{3025}=60$$

$$\begin{array}{rr} \sqrt[2]{3025}(55 & \\ 25 & 5 \\ \hline 105)525 & 60 \\ 525 & \\ \hline \end{array}$$

$$\begin{array}{rr} \text{Length } 60 & \qquad \text{Breadth } 10 \\ 10 & 2 \\ \hline 50 & 12 \\ 12 & \\ \hline 600 & \end{array}$$

 Literally.

Literally.

Let $600=a$, $10=b$, $2=c$

$$\frac{\frac{x-b}{1}\times\frac{a+cx}{x}}{x} \qquad \frac{ax-ab+cxx-bcx}{x} \qquad \frac{a}{x}+c \text{ is } \frac{a+cx}{x}$$

Then $\frac{ax-ab+cxx-bcx}{x}=a$

$\therefore ax-ab+cxx-bcx=ax$

$\therefore cxx-bcx-ab=0$

$\therefore cxx-bcx=ab$

$\therefore xx-bx=\frac{ab}{c}$

$\therefore xx-bx+\frac{bb}{4}=\frac{bb}{4}+\frac{ab}{c}$

$\therefore x-\frac{b}{2}=\sqrt[2]{\frac{bb}{4}+\frac{ab}{c}}$

$\therefore x=\frac{b}{2}+\sqrt[2]{\frac{bb}{4}+\frac{ab}{c}}=60$

$$\begin{array}{r} 600=a \\ 10=b \\ \hline c=2)6000=ab \\ \hline 3000 \end{array} \qquad \begin{array}{r} 10=b \\ 10=b \\ \hline 4)100=bb \\ \hline 25 \end{array}$$

$$\begin{array}{r} 3000 \\ \sqrt[2]{3025}(55 \\ 5 \\ \hline 60 \end{array}$$

9. A Man buys a *Horse*, which he sells again for 56*l.* and gains as many *Pounds* in the *Hundred* as the *Horse* cost him. What did he give for the *Horse*?

Numerically.

x, the Price of the Horse.

$56-x$, gained.

As $100 : x :: x : 56-x$

$\therefore xx=5600-100x$

$\therefore xx+100x=5600$

$\therefore xx+100x+2500=8100$

$\therefore x+50=\sqrt[2]{8100}$

$\therefore x=-50+\sqrt[2]{8100}=40$

As 100 : 40 : 40 : 16

$$\begin{array}{r} 16 \\ \hline 1600 \end{array} \qquad \begin{array}{r} 40 \\ \hline 1600 \end{array}$$

Literally.

Let $56 = a$ As $b : x :: x : a - x$

$100 = b$ $\therefore xx = ba - bx$

$$\begin{array}{l} 56 = a \\ \underline{100 = b} \\ 5600 = ab \end{array} \qquad \begin{array}{l} 100 = b \\ \underline{100 = b} \\ 4|10000 = bb \\ 2500 \\ \underline{5600} \\ \sqrt[2]{8100}|90 \\ \underline{50} \\ 40 \end{array}$$

$\therefore xx + bx = ba$

$\therefore xx + bx + \frac{bb}{4} = \frac{bb}{4} + ba$

$\therefore x + \frac{b}{2} = \sqrt[2]{\frac{bb}{4} + ba}$

$\therefore x = -\frac{b}{2} + \sqrt[2]{\frac{bb}{4} + ba}$

10. A *Linnen Draper*, buys 2 Sorts of *Linnen* for 30 *l.* one Sort *Fine*, the other *Coarſe*. An *Ell* of the *Fine* coſt as many Pounds as he had *Ells*. He bought 28 *Ells* of the *Coarſe* at ſuch a Price, that 8 *Ells* of the *Coarſe* coſt as many Pounds as one *Ell* of the *Fine*. How many *Ells* of the *Fine* did he buy, and what Price did he give for them both.

Numerically.

x, the Number of fine Ells.

xx, the Price of the Fine.

As $8 : x :: 28 : \frac{28x}{8}$ the Price of the Coarſe.

$$\text{Then } xx + \frac{28x}{8} = 30$$

$$\therefore xx + \frac{7x}{2} = 30$$

$$\therefore xx + \frac{7x}{2} = \frac{49}{16} + 30 = \frac{529}{16}$$

$\therefore x+\frac{7}{4}=\sqrt[2]{\frac{529}{16}}$ $\quad$ $\sqrt[2]{529}\,|\,23$; 4; $43\,|\,129$; 0

$\therefore =-\frac{7}{4}+\sqrt[2]{\frac{529}{16}}=4$

$\frac{23}{4}-\frac{7}{4}$ is $\frac{16}{4}=4$ $\quad$ 4×4

As 8 : 4 :: 28 : 14

16 Price of Fine.
14 Price of Coarse.
30

Literally.

Let $30=a$, $28=b$, $8=c$ $\quad$ As $c:x::b:\frac{bx}{c}$

Then $xx+\frac{bx}{c}=a$

$64=cc$, $\times 4$, $256=4cc$ $\quad$ $28=b$, $28=b$, 224, 56, $784=bb$, $256=4cc$

$\therefore xx+\frac{bx}{c}+\frac{bb}{4cc}=\frac{bb}{4cc}+a$

$\therefore x+\frac{b}{2c}=\sqrt[2]{\frac{bb}{4cc}+a}$

$\therefore x=-\frac{b}{2c}+\sqrt[2]{\frac{bb}{4cc}+a}=4$

8464

784 $\quad$ 7680

$\frac{784}{256}+\frac{30}{1}$

256

$\sqrt[2]{256}\,|\,16$; 1; $26\,|\,156$; 156; 0 $\quad$ $\sqrt[2]{8464}\,|\,92$; 81; $182\,|\,364$; 364; 0

$\frac{92}{16}-\frac{28}{16}$ is $\frac{64}{16}=4$

11. Of

11. Of 3 *proportional* Numbers; the *middle* Term is 12; and the Difference between the *Extreams* is 10. I demand the Numbers?

Numerically.

$$\overset{(1)}{x} : \overset{(2)}{12} : \overset{(3)}{x+10}$$

Then $\overline{xx+10x}=144$ (multiplying the first and third by x)

$\therefore\ xx+10x+25=169$

$\therefore\ x+5=\sqrt[2]{169}$

$\therefore\ x=-5+\sqrt[2]{169}=8$

$\sqrt[2]{169}\,|\,13$; 1; $23|69$; 69; 0; $\frac{5}{8}$

$8 : 12 : 18$

$12 \times 12 = 144 = 8 \times 18 = 144$

Literally.

Let $12=a$, $10=b$

$$\overset{1}{x} : \overset{2}{a} : \overset{3}{x+b}$$

Then $\overline{xx+bx}=aa$

$\therefore\ xx+bx+\frac{bb}{4}=\frac{bb}{4}+aa$

$\therefore\ x+\frac{b}{2}=\sqrt[2]{\frac{bb}{4}+aa}$

$\therefore\ x=-\frac{b}{2}+\sqrt[2]{\frac{bb}{4}+aa}=8$

$10=b$
$10=b$
$4|100=bb$
25
$144=aa$
$\sqrt[2]{169}\,|\,13$
$\frac{5}{8}$

12. Of *three* proportional Numbers; the Sum of the *first* and *second* is 10; and the Difference between the *second* and *third* is 24. What are the Numbers?

Numeri-

Numerically.

$$\overset{1}{10-x} : \overset{2}{x} : \overset{3}{x+24} \qquad \sqrt[2]{529}\,|\,23$$

$$\begin{array}{r} 10-x \\ \hline 10x+240 \\ -xx-24x \\ \hline \end{array} \qquad \begin{array}{r} 4 \\ \hline 43\,|\,129 \\ 129 \\ \hline 0 \end{array}$$

Then $xx=-14x+240-xx$

$\therefore\ 2xx+14x=240 \qquad \frac{23}{2}-\frac{7}{2}$ is $\frac{16}{8}=8$

$\therefore\ xx+7x=120$

$$\therefore\ xx+7x+\frac{49}{4}=\frac{49}{4}+120=\frac{529}{4}$$

$$\therefore\ x+\frac{7}{2}=\sqrt[2]{\frac{529}{4}}$$

$$\therefore\ x=-\frac{7}{2}+\sqrt[2]{\frac{529}{4}}=8$$

$$\begin{array}{ccccc} 2 & : & 8 & : & 32 \\ & & 8 & & 2 \\ \hline & & 64 & = & 64 \end{array}$$

Literally.

Let $10=a \qquad \overset{1}{a-x} : \overset{2}{x} : \overset{3}{x+b}$

$24=b \qquad x+b$

Then $ax-xx+ab-bx=xx$

$14=c \quad \therefore\ ax+ab-bx=2xx$

$14=c \quad \therefore\ ab=2xx+bx-ax.$ Let $b-a=c=14$

$56 \qquad \therefore\ 2xx-cx=ab \qquad 24=b$

$14 \qquad \therefore\ xx-\frac{cx}{2}=\frac{ab}{2} \qquad 10=a$

$cc=\frac{196}{16}=\frac{49}{4} \qquad 2\,|\,240=ab$

120

$\frac{529}{49\ \ 480} \qquad \therefore\ xx-\frac{cx}{2}+\frac{cc}{16}=\frac{cc}{16}+\frac{ab}{2}$

$\frac{\frac{49}{4}+\frac{120}{1}}{4} \qquad \therefore\ x-\frac{c}{4}=\sqrt[2]{\frac{cc}{16}+\frac{ab}{2}}=8$

$$\sqrt[2]{\frac{529}{4}}\,\Big|\,\frac{23}{2}-\frac{7}{2}=\frac{16}{2}=8$$

13. Of *four* proportional Numbers, the *third* is 12, and the Sum of the *first* and *second* is 8. Besides, if the *second* Number be subtracted from its *Square*, it will leave the *fourth*. What are the Numbers?

Numerically.

$$\overset{1}{8-x} : \overset{2}{x} : \overset{3}{12} : \overset{4}{xx-x}$$

$$\frac{12}{} \qquad \frac{8-x}{}$$

$$\text{Then } 12x = 8xx-8x-xxx+xx$$

$$\therefore 12=8x-8-xx+x \qquad \frac{81}{4}-20=\frac{1}{4}$$

$$\therefore 12=9x-8-xx$$

$$\therefore xx-9x+12=-8 \qquad \sqrt[2]{\frac{1}{4}} \Big| \frac{1}{2}$$

$$\therefore xx-9x=-20$$

$$\therefore xx-9x+\frac{81}{4}=\frac{81}{4}-20$$

$$\therefore x-\frac{9}{2}\ \sqrt[2]{\frac{81}{4}-20} \qquad \frac{9}{2}+\frac{1}{2}=\frac{10}{2}=5$$

$$\therefore x=\frac{9}{2}+\sqrt[2]{\frac{81}{4}-20}=5$$

$$3 : 5 : 12 : 20$$

$$\frac{5}{60}=\frac{3}{60}$$

Literally.

Let $12=a$
$8=b$

$$\overset{1}{b-x} : \overset{2}{x} : \overset{3}{a} : \overset{4}{xx-x}$$

$$\frac{x}{}$$

$$\frac{xx-x}{} \quad ax$$

$$bxx-xxx-bx+xx=ax$$

$$\therefore bx-xx-b+x=a$$

$$\therefore xx-bx+b-x=-a$$

Let $-b-1=-c=-9$ ∴ $xx-bx-x=-a-b$

$$\begin{array}{lll} \quad 1 & & \\ 81 & 80 & 9=c \\ 81 & 20 & 9=c \\ \frac{81}{4}- & \frac{20}{1} & \frac{81}{4}=cc \\ \quad 4 & & \quad 4 \end{array}$$

∴ $xx-cx=-a-b$

∴ $xx-cx+\frac{cc}{4}=\frac{cc}{4}-a-b$

∴ $x-\frac{c}{2}=\sqrt[2]{\frac{cc}{4}-a-b}$

$\sqrt[2]{\frac{1}{4}}\,\Big|\,\frac{1}{2}+\frac{9}{2}=5$ ∴ $x=\frac{c}{2}+\sqrt[2]{\frac{cc}{4}-a-b}=5$

14. Of *four* proportional Numbers, there is given the Sum of the *Means* 24, and likewise the Sum of the *Extremes* 56. What are the Numbers?

Numerically.

$$\overset{1}{\frac{xx}{24-x}} : \overset{2}{x} : \overset{3}{24-x} : \overset{4}{56-\frac{xx}{24-x}} \text{ that is } \frac{1344-56x-xx}{24-x}$$

$$\frac{1344xx-56xxx-xxxx}{576-48x+xx} \qquad \frac{1344-56x-xx}{24-x}\times\frac{xx}{24-x}$$

$$\begin{array}{r} 56 \\ 24 \\ \hline 224 \\ 112 \\ \hline 1344 \end{array} \qquad \begin{array}{r} 24-x \\ x \\ \hline 24x-xx \end{array}$$

Then $\frac{1344xx-56xxx-xxxx}{576-48x+xx}=24x-xx$

$$\begin{array}{l} 576-48x+xx \\ \quad\;\; 24x-xx \\ \hline 13824x-1152xx+24xxx \\ -576xx+48xxx-xxxx \\ \hline 13824x-1728xx+72xxx-xxxx \end{array} \qquad \begin{array}{r} 576 \\ 24 \\ \hline 2304 \\ 1152 \\ \hline 13824 \end{array} \qquad \begin{array}{r} 48 \\ 24 \\ \hline 192 \\ 96 \\ \hline 1152 \end{array}$$

Now

Now

$$1344xx-56xxx-xxxx=13824x-1728xx+72xxx-xxxx$$

$$\therefore\ 1344xx-56xxx=13824x-1728xx+72xxx$$

$$\therefore\ 1344x-56xx=13824-1728x+72xx$$

$$\therefore\ 1344x=13824-1728x+128xx$$

$$\therefore\ 128xx-3072x=-13824$$

$$\therefore\ xx-24x=-108$$

$$\therefore\ xx-24x+144=36$$

$$\therefore\ x-12=\sqrt[2]{36}$$

$$\therefore\ x=12+\sqrt[2]{36}=18$$

$$\begin{array}{cccc} \overset{1}{54} : & \overset{2}{18} : & \overset{3}{6} : & \overset{4}{2} \\ \underline{2} & \underline{6} & & \\ 108 = & 108 & & \end{array}
\qquad
\begin{array}{r} 18 \\ \underline{18} \\ 144 \\ \underline{18} \\ 6)\underline{324} \\ 54 \end{array}$$

Literally.

Let $24=a$, $56=b$; $\overset{1}{\dfrac{xx}{a-x}} : \overset{2}{x} : \overset{3}{a-x} : \overset{4}{b-\dfrac{xx}{a-x}}$ is $\dfrac{ba-bx-xx}{a-x}$

$$\frac{baxx-bxxx-xxxx}{\dfrac{ba-bx-xx}{a-x}\times\dfrac{xx}{a-x}} \qquad \frac{x}{ax-xx}$$

$$aa-2ax+xx$$

Then $\dfrac{baxx-bxxx-xxxx}{aa-2ax+xx}=ax-xx$

$$\begin{array}{l} aa-2ax+xx \\ \underline{\quad ax-xx} \\ aaax-2aaxx+axxx \\ \underline{-aaxx+2axxx-xxxx} \\ aaax-3aaxx+3axxx-xxxx \end{array}$$

Now $baxx-bxxx-xxxx=aaax-3aaxx+3axxx-xxxx$

$$\therefore\ baxx-bxxx=aaax-3aaxx+3axxx$$

$$\therefore\ bax-bxx=aaa-3aax+3axx$$

$$\therefore\ 3axx+bxx-3aax-bax=-aaa$$

Let $3a+b=c$; and $-3aa-ba=-d$

 Then

Then $cxx - dx = -aaa$

$$\therefore xx - \frac{dx}{c} = -\frac{aaa}{c}$$

$$\therefore xx - \frac{dx}{c} + \frac{dd}{4cc} = \frac{dd}{4cc} - \frac{aaa}{c}$$

$$\therefore x - \frac{d}{2c} = \sqrt[2]{\frac{dd}{4cc} - \frac{aaa}{c}}$$

$$\therefore x = \frac{d}{2c} + \sqrt[2]{\frac{dd}{4cc} - \frac{aaa}{c}} = 18$$

24 = a
24 = a
96
48
576 = aa

24 = a
56 = b
144
120
1344 = ab

576 = aa
3
1728 = $3aa$
− 1344 = ab
3072 = d

24 = a
3
72 = $3a$
− 56 = b
128 = c
128
1024
256
128
16384 = cc
4
65536 = $4cc$

3072 = d
3072 = d
6144
21504
92260
65536)9447184(144
289358
272144
0

$\sqrt[2]{108}$
36(6
0

256)3072(12
512
0

24 = a
24 = a
576 = aa
24 = a
2304
1152
128)13824(108
1024
0

6 + 12 = 18

15. Two *Country-women*, *A* and *B*, carry together 100 *Eggs* to Market; and in the Sale of them, one took as much Money as the other. But *A*, who had the largest *Eggs*, says to *B*, had I carried as many *Eggs* as you, I should have had 18 *Pence* for them. But, replies *B*, if I had brought as

as many as you, I should have had but 8 *Pence* for them. How many *Eggs* had each?

Numerically.

x, the Eggs *A* had.
$100-x$, the Eggs *B* had.

$$\text{As } 100-x : 18 :: x : \frac{18x}{100-x}$$

$$\text{As } x : 8 :: 100-x : \frac{800-8x}{x}$$

$$\text{Then } \frac{18x}{100-x} = \frac{800-8x}{x}$$

$$\begin{array}{r}
800-8x \\
100-x \\
\hline
80000-800x \\
-800x+8xx \\
\hline
80000-1600x+8xx
\end{array}$$

$\therefore 18xx = 8000 - 1600x + 8xx$
$\therefore 10xx = 80000 - 1600x$
$\therefore 10xx + 1600x = 80000$
$\therefore xx + 160x = 8000$
$\therefore xx + 160x + 6400 = 14400$

$$\therefore x + 80 = \sqrt[2]{14400}$$

$$\therefore x = -80 + \sqrt[2]{14400} = 40$$

A had 40 Eggs, and *B* 60.

As 60 : 18 :: 40 : 12

$$\begin{array}{c}
40 \\
\hline
6|0)72|0 \\
\hline
12
\end{array}$$

As 40 : 8 : 60

$$\begin{array}{c}
60 \\
\hline
4|0)48|0 \\
\hline
12
\end{array}$$

Literally.

Literally.

Let $100 = a$
$18 = b$
$8 = c$

As $a - x : b :: x : \dfrac{bx}{a-x}$

As $x : c :: a - x : \dfrac{ca - cx}{x}$

Then $\dfrac{bx}{a-x} = \dfrac{ca-cx}{x}$

$$\begin{array}{r}ca - cx\\ a - x\\ \hline caa - cax\\ -cax + cxx\\ \hline caa - 2cax + cxx\end{array}$$

$\therefore\ bxx = caa - 2cax + cxx$

$\therefore\ bxx - cxx = caa - 2cax$

Let $b - c = d = 10$

Then $dxx = caa - 2cax$

$\therefore\ dxx + 2cax = caa$

$$\therefore\ xx + \frac{2cax}{d} = \frac{caa}{d}$$

$$\therefore\ xx + \frac{2cax}{d} + \frac{ccaa}{dd} = \frac{ccaa}{dd} + \frac{caa}{d}$$

$$\therefore\ x + \frac{ca}{d} = \sqrt[2]{\frac{ccaa}{dd} + \frac{caa}{d}}$$

$$\therefore\ x = -\frac{ca}{d} + \sqrt[2]{\frac{ccaa}{dd} + \frac{caa}{d}} = 40$$

$$\begin{array}{r}100 = a\\ 100 = a\\ \hline 10000 = aa\\ 64 = cc\\ \hline dd = 100)640000(6400\\ 8000\\ \sqrt[2]{14400}(120\\ 80\\ \hline 40\end{array}
\qquad
\begin{array}{r}10000 = aa\\ 8 = c\\ \hline d = 10)80000(8000\end{array}
\qquad
\begin{array}{r}100 = a\\ 8 = c\\ \hline d = 10)800(80\\ \hline 0\end{array}$$

16. Two Countrymen, *A* and *B*, sell their Corn at different Prices. *A* sold 20 *Bushels*, and *B* re-

B received for 1 *Bushel*, as many *Shillings* as he sold *Bushels*. *A* perceives, that if he had sold as many *Bushels* as *B* received *Shillings*, he should then have received 252 *Shillings*: But both together received 176 *Shillings*. How many *Bushels* did *B* sell, and what Price had *A*?

Numerically.

x, the Price of *B*'s Bushels.
$176-x$, the Price of *A*'s.

As $176-x : 252 :: 20 : x$
$\qquad\qquad x \qquad\quad 20$

Then $176x-xx=5040$
∴ $xx-176x=-5040$
∴ $xx-176x+7744=2704$
∴ $xx-88=\sqrt[2]{2704}$
∴ $x=88+\sqrt[2]{2704}=140$

$$\begin{array}{r} 88 \\ 88 \\ \hline 704 \\ 704 \\ \hline 7744 \\ 5040 \\ \hline \sqrt{2704}(52 \\ 25 \\ \hline 102)204 \\ 204 \\ \hline 0 \end{array} \qquad \begin{array}{r} 88 \\ 52 \\ \hline 140 \end{array}$$

$$\begin{array}{r} 176 \\ 140 \\ \hline 36 \end{array}$$

36, the Price of *B*'s Bushels. ∴ *B* had 6 Bush.

As $36 : 252 : 20 : 140$

$$\begin{array}{r} 252 \\ 20 \\ \hline 5040 \end{array} \qquad \begin{array}{r} 140 \\ 36 \\ \hline 840 \\ 420 \\ \hline 5040 \end{array}$$

Literally.

Let $20=a$ $\quad x$, the Price of *A*'s Bushels.
$252=b$ $\quad c-x$, the Price of *B*'s.
$176=c$ $\quad$ Then, as $c-x : b :: a : x$

176 = c $\therefore cx - xx = ab$
176 = c $\therefore xx - cx = -ab$
1056 $\therefore xx - cx + \frac{cc}{4} = \frac{cc}{4} - ab$
1232
176
4|30976 = cc $\therefore x - \frac{c}{2} = \sqrt[2]{\frac{cc}{4} - ab}$ 252 = b, 20 = a, 5040 = ab
7744
5040
$\sqrt[2]{2704}$|52 + 88 = 140

$\therefore x = \frac{c}{2} + \sqrt[2]{\frac{cc}{4} - ab} = 140$ 2|176 = c, 88

17. Two *Merchants* sell 21 *Ells* of *Cloth*: The *first* sells one *Ell* for as many *Crowns* as is $\frac{1}{5}$ of the Number *Ells* that the *second* had; and the *second* sells one *Ell* for as many *Crowns* as is $\frac{1}{3}$ of the Number of *Ells* that the *first* had. The Sale being over, they had taken 48 *Crowns*. How many *Ells* did each sell, and at what Price?

Numerically.

x, the Number of Ells the first sold.
$21 - x$, the Number the second sold.

As $1 : \frac{21-x}{5} :: x : \frac{21x - xx}{5}$ 48, 15, 240

As $1 : \frac{x}{3} :: 21 - x : \frac{21x - xx}{3}$ 48, 720

Then $\frac{21x - xx}{5} + \frac{21x - xx}{3} = 48$

$\therefore 63x - 3xx + 105x - 5xx = 720$
$\therefore 168x - 8xx = 720$
$\therefore 8xx - 168x = -720$
$\therefore xx - 21x = -90$

$\therefore xx$

$$\because\ xx - 21x + \frac{441}{4} = \frac{441}{4} - 90 = \frac{81}{4}$$

$$\because\ x - \frac{21}{4} = \sqrt[2]{\frac{81}{4}}$$

$$\because\ x = \frac{21}{2} + \sqrt[2]{\frac{81}{4}} = 15, \text{ too great.}$$

$$\because\ x = \frac{21}{2} - \sqrt[2]{\frac{81}{4}} = 6, \text{ the first's Ells.}$$

15, the second's Ells.

$$\sqrt[2]{\frac{81}{4}} - \frac{9}{2} + \frac{21}{2} \text{ is } \frac{12}{2} = b$$

The Price of the first	18
The Price of the second	30
	48

Literally.

Let $21 = a$

$48 = b$

x, the Number of Ells the first had.

$a - x$, the Number the second had.

$$\text{As } 1 : \frac{a-x}{5} :: x : \frac{ax - xx}{5}$$

$$\text{As } 1 : \frac{x}{3} :: a - x : \frac{ax - xx}{3}$$

$$\text{Then } \frac{ax - xx}{5} + \frac{ax - xx}{3} = b$$

$$\because\ 3ax - 3xx + 5ax - 5xx = 15b$$

$$\because\ 8ax - 8xx = 15b \qquad 48 = b \qquad 21 = a$$

$$\because\ ax - xx = \frac{15b}{8} \qquad \frac{15}{240} \qquad \frac{21 = a}{21}$$

$$\because\ xx - ax = \frac{15b}{8} \qquad 8\,|\,\frac{48}{720} \qquad \frac{42}{441} = aa$$

$$\because\ xx - ax + \frac{aa}{4} = \frac{aa}{4} - \frac{15b}{8} \qquad \frac{441}{4}$$

 $\because\ x -$

$$\therefore x - \frac{a}{2} = \sqrt[2]{\frac{aa}{4} - \frac{15b}{8}}$$

$$\therefore x = \frac{a}{2} + \sqrt[2]{\frac{aa}{4} - \frac{15b}{8}} = 15 \text{ too great.}$$

$$\therefore x = \frac{a}{2} - \sqrt[2]{\frac{aa}{4} - \frac{15b}{8}} = 6$$

18. Two *Men* have a Parcel of Silk, the *first* 40 *Ells*, the *second* 30. The *first* ſells for a *Guinea* $\frac{1}{3}$ of an *Ell* more than the *ſecond.* When the Sale was over, they had taken between them 42 *Guineas.* How many *Ells* did each of them ſell for a *Gnìnea?*

Numerically.

x, the Number of Ells the firſt ſold for a Guinea.

$\frac{3x-1}{3}$ the Number of Ells the ſecond ſold for a Guinea.

As $x : 1 :: 40 : \frac{40}{x}$ the Price of the firſt.

As $\frac{3x-1}{3} : 1 :: 90 : \frac{270}{3x-1}$ the Price of the ſecond.

Then $\frac{40}{x} + \frac{270}{3x-1}$ is $\frac{120x-40+270x}{3xx-x}$

$$\therefore \frac{120x-40+270x}{3xx-x} = 42$$

$$\therefore 120x-40+270x = 126xx-42x$$

$$\therefore 390x-40 = 126xx-42x$$

$$\therefore 126xx-432x = -40$$

18)432(24
72
0

$$\therefore xx - \frac{432x}{126} = -\frac{40}{126}$$

18)126(7
0

$$\therefore xx - \frac{24x}{7} = -\frac{20}{63}$$

$$\therefore xx - \frac{24x}{7} + \frac{144}{49} = \frac{144}{49} - \frac{20}{63} = \frac{8092}{3087} = \frac{1156}{441}$$

$\therefore x - \frac{12}{7} = \sqrt[2]{\frac{1156}{441}}$ $\sqrt[2]{1156}(34$

9

$64)256$

256

0

$\therefore x = \frac{12}{7} + \sqrt[2]{\frac{1156}{441}} = 34$

490

$238 \quad 252$

$\frac{34}{21} + \frac{12}{7}$

$147)490(3 \frac{49}{147} = 3\frac{1}{3}$

49

$\sqrt[2]{441}(21$

4

$41)41$

41

0

As $3\frac{1}{3} : 1 :: 40 :$ As $3 : 1 :: 90 : 30$

3 3 12

10 $10)120(12$ 42

120

0

Literally.

Let $40 = a$
$90 = b$
$42 = c$

As $x : 1 :: a : \frac{a}{x}$

As $\frac{x3-1}{3} : 1 :: b : \frac{3b}{3x-1}$

$\frac{a}{x} + \frac{3b}{3x-1}$ is $\frac{3ax-a+3bx}{3xx-x}$

Then $\frac{3ax-a+3bx}{3xx-x} =$

$\therefore 3ax-a+3bx = 3cxx-cx$ $42 = c$

$\therefore 3cxx-cx-3bx-3ax = -a$ $270 = 3b$

Let $-c-3b-3a = -d = 432$ $120 = 3a$

Then $3cxx-dx = -a$ $432 = d$

$\therefore xx - \frac{dx}{3c} = -\frac{a}{3c}$ $432 = d$

864

1296

$\therefore xx - \frac{dx}{3c} + \frac{dd}{36cc} = \frac{dd}{36cc} - \frac{a}{3c}$ 1728

$186624 = dd$

$$\therefore x - \frac{d}{6c} = \sqrt[2]{\frac{dd}{36cc} - \frac{a}{3c}}$$

$$\therefore x = \frac{d}{6c} + \sqrt[2]{\frac{dd}{36cc} - \frac{a}{3c}} = 3\tfrac{1}{3}$$

$$\frac{186624}{63504} = \frac{144}{49} - \frac{20}{63} = \frac{1156}{441}$$

$$\sqrt[2]{\frac{1156}{441}} \Big| \frac{34}{21} + \frac{36}{21} = \frac{70}{21} = 3\tfrac{1}{3}$$

$$\begin{array}{r} 42=c \\ 42=c \\ \hline 84 \\ 168 \\ \hline 1764=cc \\ 36 \\ \hline 10584 \\ 5292 \\ \hline 63504=36cc \end{array}$$

$$\frac{432}{256} = \frac{36}{21}$$

19. To find a *Number*, to the *Quadruple* of which, if you add 91, the Whole shall be, to the *Square* of the Number sought, as 3 to 4.

Numerically.

x, the Number sought.

Then, as $4x + 91 : xx :: 3 : 4$

$$\begin{array}{ccc} 4 & & xx \\ \hline \therefore 16x + 364 & = & 3xx \end{array}$$

$$3xx - 16x = 364$$

$$\therefore xx - \frac{16x}{3} = \frac{364}{3}$$

$$\therefore xx - \frac{16x}{3} + \frac{64}{9} = \frac{64}{9} + \frac{364}{3}$$

$$\therefore x - \frac{8}{3} = \sqrt[2]{\frac{64}{9} + \frac{364}{3}}$$

$$\therefore x = \frac{8}{3} + \sqrt[2]{\frac{64}{9} + \frac{364}{3}} + 14$$

$$\begin{array}{r} \sqrt[2]{1156}|34 \\ 9 \\ \hline 64)256 \\ 156 \\ \hline \end{array}$$

$$\begin{array}{r} 14 \\ 14 \\ \hline 56 \\ 14 \\ \hline 196 \end{array}$$

64

$$\frac{64}{9}+\frac{364}{3} \text{ is } \frac{3468}{27}=\frac{1156}{9} \qquad \begin{array}{r}14\\ \underline{4}\\ 56\\ \underline{91}\\ 147\end{array}$$

$$\sqrt[2]{\frac{1156}{9}} \Big| \frac{34}{3}+\frac{8}{3} \text{ is } \frac{42}{3}=14$$

$$\text{As } 147 : 196 :: 3 : 4$$

$$\begin{array}{r}\underline{4}\\ 588\end{array} = \begin{array}{r}\underline{3}\\ 588\end{array}$$

Literally.

Let $91=a$, $3=b$, $4=c$

$$\text{As } cx+a : xx :: b : c$$

$$\frac{c}{\text{Then } ccx+ca} = \frac{b}{bxx} \qquad \begin{array}{r}91\\ \underline{4}\\ \underline{364}\\ 3\end{array}$$

$$\therefore bxx-ccx=ca$$

$$\therefore xx-\frac{ccx}{b}=\frac{ca}{b}$$

$$\therefore xx-\frac{ccx}{b}+\frac{cccc}{4bb}=\frac{cccc}{4bb}+\frac{ca}{b}$$

$$\therefore x-\frac{cc}{2b}=\sqrt[2]{\frac{cccc}{4bb}+\frac{ca}{b}}$$

$$\therefore x=\frac{cc}{2b}+\sqrt[2]{\frac{cccc}{4bb}+\frac{ca}{b}}=14$$

$$\begin{array}{l}9=bb\\ \underline{4}\\ 36=4bb\end{array} \qquad \begin{array}{l}4=c\\ \underline{4=c}\\ 16=cc\\ \underline{4}\\ 64=ccc\\ \underline{4}\end{array}$$

$$\frac{cccc=256}{4bb=36}=\frac{64}{9}$$

$\frac{64}{9}+\frac{364}{3}$ is, as above, &c.

20. To find a *Number*, from the *Double* of which, if you subtract 12, the *Square* of the Remainder shall be 9 Times the Number sought, *less* 1.

Numerically.

x, the Number sought.

Then $4xx-48x+144-1=9x$

$\therefore 4xx-48x+143=9x$

$\therefore 4xx-57x+143=0$

$\therefore 4xx-57x=-143$

$\therefore xx-\frac{57x}{4}=-\frac{143}{4}$

$$\begin{array}{r} 2x-12 \\ 2x-12 \\ \hline 4xx-24x \\ -24x+144 \\ \hline 4xx-48x+144 \end{array} \qquad \begin{array}{r} 57 \\ 57 \\ \hline 399 \\ 285 \\ \hline 3249 \end{array}$$

$$\begin{array}{r} 143 \\ 64 \\ \hline 572 \\ 858 \\ \hline 9152 \end{array}$$

$$\frac{3844}{\frac{12996 \quad 9152}{\frac{\frac{3249}{64}-\frac{143}{4}}{256}}}$$

$\because xx-\frac{57x}{4}+\frac{3249}{64}=\frac{3249}{64}-\frac{143}{4}$

$\because x-\frac{57}{8}=\frac{\sqrt{3844}}{256}$

$\therefore x=\frac{57}{8}+\frac{\sqrt{3844}}{256}=11$

$$\begin{array}{r|l} \sqrt{3844} & 62 \\ 36 & \\ \hline 122 \;\; 244 & \\ 244 & \\ \hline 0 & \end{array} \qquad \begin{array}{r|l} \sqrt{256} & 16 \\ 1 & \\ \hline 26 \;\; 156 & \\ 156 & \\ \hline 0 & \end{array}$$

$\frac{62}{16}$ is $\frac{31}{8}+\frac{57}{8}$ is $\frac{88}{8}=11$

$$\begin{array}{r} 11 \\ 9 \\ \hline 99 \end{array} \qquad \begin{array}{r} 10 \\ 10 \\ \hline 100-1, \text{ is } 99 \end{array} \qquad \begin{array}{r} 11 \\ 2 \\ \hline 22 \\ 12 \\ \hline 10 \end{array}$$

Literally.

$12=a$

$1=b$

$9=c$

$$\begin{array}{r} x \\ 2 \\ \hline 2x-a \\ 2x-a \\ \hline 4xx-2ax \\ -2ax+aa \\ \hline 4xx-4ax+aa \end{array}$$

Then $4xx-4ax+aa-b=cx$

$\therefore 4xx-4ax-cx+aa-b=0$

$\therefore 4xx-4ax-cx=b-aa$

Let $-4a-c=-d=-57$

Then $4xx-dx=b-aa$

$\therefore xx-\frac{dx}{4}=\frac{b-aa}{4}$

$48=4a$

$$\begin{array}{ll} 48=4a & 1=b \\ \underline{9=c} & \underline{-144=aa} \\ 57=d & -143 \\ \underline{57=d} & \end{array}$$

$$\therefore xx-\frac{dx}{4}+\frac{dd}{64}=\frac{dd}{64}+\frac{b-aa}{4}$$

$dd=\frac{3249}{64}=\frac{143}{4}$ &c. as aforegoing.

$$\therefore x-\frac{d}{8}=\sqrt[2]{\frac{dd}{64}+\frac{b-aa}{4}}$$

$$\therefore x=\frac{d}{8}+\sqrt[2]{\frac{dd}{64}+\frac{b-aa}{4}}=11$$

21. To divide the *Number* 19 into 2 Parts, so that the Sum of the *Squares* of both Parts may be 193.

Numerically.

$$\begin{array}{ll} \square x & \square 19-x \\ & \underline{19-x} \\ & 361-19x \\ & \underline{-19x+xx} \\ & 361-38x+xx \end{array} \qquad \begin{array}{r} 19 \\ \underline{19} \\ 171 \\ \underline{19} \\ 361 \end{array}$$

Then $xx+361-38x+xx=193$

$\therefore 2xx-38x+361=193$

$\therefore 2xx-38x=-168$

$\therefore xx-19x=-84$

$$\begin{array}{r} 25 \\ \hline 361 \quad 336 \\ \hline \frac{361}{4} - 84 \\ \hline 4 \end{array} \qquad \begin{array}{r} 19 \\ \underline{19} \\ 171 \\ \underline{19} \\ 361 \end{array}$$

$$\therefore xx-19x+\frac{361}{4}=\frac{361}{4}-84=\frac{25}{4}$$

$$\therefore x-\frac{19}{2}=\sqrt[2]{\frac{25}{4}} \qquad \sqrt[2]{\frac{25}{4}}\,\Big|\,\frac{5}{2}+\frac{19}{2}\text{ is }\frac{24}{2}=12$$

$$\therefore x=\frac{19}{2}+\sqrt[2]{\frac{25}{4}}=12$$

$$\begin{array}{ll} \square 12 & \square 7 \\ \underline{12} & \underline{7} \\ 144 & +\ 49=193 \end{array}$$

Literally.

Let $19=a$ $\qquad \ulcorner x \quad \urcorner\ a-x$

$193=b$

$$\begin{array}{r} a-x \\ a-x \\ \hline aa-2ax+xx \end{array}$$

Then $xx+aa-2ax+xx=b$

$\because\ 2xx+aa-2ax=b$

$\because\ 2xx-2ax=b-aa$

$\because\ xx-ax=\dfrac{b-aa}{2}$

$\because\ xx-ax+\dfrac{aa}{4}=\dfrac{aa}{4}+\dfrac{b-aa}{2}$

$\because\ x-\dfrac{a}{2}=\sqrt[2]{\dfrac{aa}{4}+\dfrac{b-aa}{2}}$

$\because\ x=\dfrac{a}{2}+\sqrt[2]{\dfrac{aa}{4}+\dfrac{b-aa}{2}}=12$

$$\begin{array}{r} 19=a \\ 19=a \\ \hline 361=aa \\ \hline 4 \end{array} \qquad \begin{array}{r} 193=b \\ -361=aa \\ \hline 2|-168 \\ \hline -84 \end{array}$$

$\dfrac{361}{4}-84$, &c. as above.

22. To divide 7 into two Parts, so that the Difference of the *Squares* made by the *treble* of the *lesser*, and *double* of the *greater* may be 17.

Numerically.

$$\begin{array}{rrr} \ulcorner x & \urcorner\ 7-x & 21 \\ 2 & 3 & 21 \\ \hline 2x & 21-3x & 21 \\ 2x & 21-3x & 42 \\ \hline 4xx & 441-63x & 441 \\ & -63x+9xx & \\ \hline & 441-126x+9xx & \end{array}$$

Then

Then $441-126x+9xx-4xx=17$

$\therefore\ 5xx+441-126x=17$

$\therefore\ 5xx-126x=-424$

$\therefore\ xx-\frac{126x}{5}=-\frac{424}{5}$

$\therefore\ xx-\frac{126x}{5}+\frac{3969}{25}=\frac{3969}{25}-\frac{424}{5}$

63	424
63	25
189	2120
378	848
3969	10600

$$\begin{array}{r} 9245 \\ \hline 19845 \quad 10600 \\ \hline \frac{3969}{25}-\frac{424}{5} \\ \hline 125 \end{array}$$

$\therefore\ x+\frac{63}{5}\sqrt{\frac{1849}{25}}$

$\therefore\ x=\frac{63}{5}-\sqrt{\frac{1849}{25}}=4$

$\frac{9245}{125}=\frac{1849}{25}$

$\sqrt{1849}|43$
16
83 249
249
0

$\frac{63}{5}-\frac{43}{5}$ is $\frac{20}{5}=4$

[4	] 3
2	3
8	9
8	9
64	91

$81-64=17$

Literally.

Let $7=a$
$17=b$

[x	] $a-x$
2	3
$2x$	$3a-3x$
$2x$	$3a-3x$
$4xx$	$9aa-18ax+9xx$

Then $9aa - 18ax + 9xx - 4xx = b$

$\therefore\ 9aa - 18ax + 5xx = b$

$\therefore\ 5xx - 18ax = b - 9aa$

$\therefore\ xx - \dfrac{18a}{5} = \dfrac{b - 9aa}{5}$

$$\begin{array}{r} 49 = aa \\ \underline{9} \\ 441 = 9aa \\ \underline{17 = b} \\ 424 \end{array} \qquad \begin{array}{r} 7 = a \\ \underline{7 = a} \\ 49 \\ \underline{81} \\ 49 \\ \underline{392} \\ 3969 = 81aa \end{array}$$

$\therefore\ xx - \dfrac{18a}{5} + \dfrac{81aa}{25} = \dfrac{81aa}{25} + \dfrac{b - 9aa}{5}$

$\therefore\ x - \dfrac{9a}{5} = \sqrt[2]{\dfrac{81aa}{25} + \dfrac{b - 9aa}{5}}$

$\therefore\ x = \dfrac{9a}{5} - \sqrt[2]{\dfrac{81aa}{25} + \dfrac{b - 9aa}{5}} = 4$

$\dfrac{3969}{25} - \dfrac{424}{5}$ is as afore going, &c.

23. A Man buys a Piece of *Linnen*, and by selling it again, he gains $12\,l. - \frac{1}{10}$ of what he bought it for; and finds by this Means, that he gained as much in the 100 as the *Linnen* cost him. What Price was the *Linnen* bought and sold at?

Numerically.

x, what the Piece cost.

Gained $12 - \dfrac{x}{10}$ that is $\dfrac{120 - x}{10}$

Then, as $x : 100 :: \dfrac{120 - x}{10} : x$

$\therefore\ xx = \dfrac{12000 - 100x}{10}$

$\therefore\ 10xx = 12000 - 100x$

$\therefore\ 10xx + 100x = 12000$

$\therefore\ xx + 10x = 1200$

$\therefore\ xx + 10x + 25 = 1225$

$$\begin{array}{rl} \sqrt[2]{1225}(& 35 \\ \underline{9} & \underline{5} \\ 9)325 & 30 \\ \underline{325} & \\ 0 & \end{array}$$

$\therefore x+5=\sqrt[2]{1225}$

$\therefore x=-5+\sqrt[2]{1225}=30$

$12-3=9$ *l.* gained.

As $30 : 100 :: 9 : 30$

$$\frac{30}{900}=\frac{9}{900}$$

Literally.

Let $12=a$ — x, the Price of the Piece.
$10=b$ — $a-\frac{x}{6}$ that is $\frac{ab-x}{b}$ gained.
$100=c$

Then, as $x : c :: \frac{ab-x}{b} : x$

$\therefore xx=\frac{cab-cx}{b}$

$\therefore bxx=cab-cx$

$\therefore bxx+cx=cab$

$\therefore xx+\frac{cx}{b}=ca$

$\therefore xx+\frac{cx}{b}+\frac{cc}{4bb}=\frac{cc}{4bb}+ca$

$\therefore x+\frac{c}{2b}=\sqrt[2]{\frac{cc}{4bb}+ca}$

$\therefore x=-\frac{c}{2b}+\sqrt[2]{\frac{cc}{4bb}+ca}=30$

$100=bb$
$\underline{4}$
$4bb=400$
$26=20|100=c$
$\underline{}$
5

$100=c$
$100=c$
$4|00|100|00=cc$
25
$1200=ca$
$\sqrt[2]{1225}|35$
$\underline{5}$
30

24. A Man buys 18 Ells of Cloth, some *Red*, the rest *Black*. What he bought of each cost 40 *Shillings*. He paid for every Ell of *Red*, one

Shilling more, than for the *Black*. How many Ells of each Sort did he buy?

Numerically.

x, the Number of Ells Black.
$18-x$, the Number of Ells Red.

As $x : 40 :: 1 : \frac{40}{x}$

As $18-x : 40 :: 1 : \frac{40}{18-x}$

Then $\frac{40}{x}+1=\frac{40}{18-x}$

$\therefore \frac{40+x}{x}=\frac{40}{18-x}$

$\therefore 720-22x-xx=40x$
$\therefore 720-62x-xx=0$
$\therefore 720=xx+62x$
$\therefore xx+62x+961=1681$
$\therefore x+31=\sqrt[2]{1681}$
$\therefore x=-31+\sqrt[2]{1681}=10$

As $10 : 40 :: 1 : 4$
As $8 : 40 :: 1 : 5$

$$\begin{array}{r} 40+x \\ 18-x \\ \hline 720+18x \\ -40x-xx \\ \hline 720-22x-xx \end{array}$$

$$\begin{array}{r} 31 \\ 31 \\ \hline 31 \\ 93 \\ \hline 961 \\ 720 \end{array}$$

$$\sqrt[2]{1681}(41$$

$$\begin{array}{r} 16 \\ \hline 81)81 \\ 81 \\ \hline 0 \end{array} \qquad \begin{array}{r} 31 \\ \hline 10 \end{array}$$

Literally.

Let $18=a$
$40=b$

As $x : b :: 1 : \frac{b}{x}$

As $a-x : b :: 1 : \frac{5}{a-x}$

Then

Then $\frac{b}{x}+1=\frac{b}{a-x}$

$\therefore \frac{b+x}{x}=\frac{b}{a-x}$

$\therefore ab+ax-bx-xx=bx$

$\therefore ab=xx+2bx-ax$

Let $2b-a=c=62$

Then $xx+cx=ab$

$\therefore xx+cx+\frac{cc}{4}=\frac{cc}{4}+ab$

$\therefore x+\frac{c}{2}=\sqrt[2]{\frac{cc}{4}+ab}$

$\therefore x=-\frac{c}{2}+\sqrt[2]{\frac{cc}{4}+ab}=10$

$$\begin{array}{r} 80=2b \\ 18=2 \\ \hline 62 \end{array} \qquad \begin{array}{r} 62=c \\ 62=c \\ \hline 124 \\ 372 \\ \hline 4|4844=cc \\ \hline 961 \\ 720=bb \\ \sqrt[2]{1681}(41 \\ \hline 31 \\ \hline 10 \end{array}$$

25. A Man buys 120 *lb.* of *Pepper*, and as much *Ginger*, and received for a *Crown*, one Pound of *Ginger*, more than of *Pepper*; ſo that the whole Price of the *Pepper*, came to 6 *Crowns* more than the Price of the *Ginger*. How many Pounds of each did he buy for a *Crown*?

Numerically.

x, the Pounds of Pepper for a Crown.
$x+1$, the Pounds of Ginger for a Crown.

As $x:1::120:\frac{120}{x}$

As $x+1:1::120:\frac{120}{x+1}$

Then $\frac{120}{x+1}+6=\frac{120}{x}$

$\therefore 120x+6xx+6x=120x+120$

$\therefore 126x+6xx=120x+120$

$\therefore bx$

$\therefore 6x+6xx=120$

$\therefore xx+x=20$

$\therefore xx+x+\frac{1}{4}=\frac{1}{4}+20$

$\therefore x+\frac{1}{2}=\sqrt[2]{\frac{1}{4}+20}$

$\therefore x=-\frac{1}{2}+\sqrt[2]{\frac{1}{4}+20}=4$

$\frac{1}{4}+20$, is $\frac{81}{4}$

$\sqrt[2]{\frac{81}{4}} \Big| \frac{9}{2}$

$\frac{9}{2}-\frac{1}{2}$ is $\frac{8}{2}=4$

As 4 : 1 :: 120 : 30

As 5 : 1 :: 120 : 24

Literally.

Let $120=a$
$6=b$

As $x : 1 :: a : \frac{a}{x}$

As $x+1 : 1 :: a : \frac{a}{x+1}$

Then $\frac{a}{x+1}+b=\frac{a}{x}$

$\therefore \frac{a+bx+b}{x+1}=\frac{a}{x}$

$\therefore ax+bxx+bx=ax+a$

$\therefore bxx+bx=a$

$\therefore xx+x=\frac{a}{b}$

$\therefore xx+x+\frac{1}{4}=\frac{1}{4}+\frac{a}{b}$ $b=6)\underline{120}=a$
20

$\therefore x+\frac{1}{2}=\sqrt[2]{\frac{1}{4}+\frac{a}{b}}$ $\frac{1}{4}+20$, is as afore.

$\therefore x=-\frac{1}{2}+\sqrt[2]{\frac{1}{4}+\frac{a}{b}}=4$

F I N I S.

ERRATA.

PAGE 3. line 31. read *it may be*.
Page 16. line last, read 65505.
Page 25. Example 4. read 3825 : 18 : 10$\frac{1}{4}$.
Page 42. Example 6. read 2 : 12 : 11
In the Table of equal Parts of a Stone, blot out 3 . . $\frac{1}{2}$
Page 58. line 7. Example 2. read 19 : 4

Example 4. read $\frac{2)5 : 7\frac{1}{2}}{2 : 9\frac{3}{4}}$

Page 60. line 2. read 3829 : 3 : 20
Page 66. line 3. read 257 : 5 : 1
Page 77. read 250 *Reas* . . 1 : 4 : $\frac{2}{8}$
line 4. Example 4. read 2 : 15 : 11 $\frac{2}{8}$
Page 86. Example 3. blot out 0$\frac{1}{4}$
Page 88. line 9. Example 1. read 1 *g* . . $\frac{1}{9}$
Page 93. line 7. read $\frac{3}{4}$ *d* is $\frac{3}{960}$
Page 101. line 9. Question 4. read .02$\frac{1}{2}$
line 10. Question 5. read .04$\frac{3}{8}$
Page 108. line 7. read 13 : 4. *per Hund. Doz.*
Page 119. read Thus $\frac{2}{3}$ of $\frac{3}{4}$ is $\frac{6}{12}$
Page 120. line 9. read $\frac{72}{8}$
Page 135. line last, read .836136666
Page 136. line 4. read .875520833
Page 145. line 6. at the End, read $= \frac{1}{400}$
line 9. read 131131 16. k 104
line 15. read 30620
Page 150. line last, read 1.93168
Page 163. line 10. Decimally, read 4
Page 166. line 5. Dec. read 36.8866
Page 170. line 9. Dec. read 3492
Page 175. line 14. Dec. read 20
Page 176. line 9. Dec. read 241.07139

$$\begin{array}{r} 241.07139 \\ 4 \\ \hline .28556 \\ 28 \\ \hline \end{array}$$

Page 197. line 26. read *April* 30
Page 198. line 14. after *July* 31. read *August* 31
Page 200. line 13. read 346.9375
Page 216. line 5. read 2000
Page 223. line 7. read 822557
Page 228. line 9. read 1500
Page 250. line 3. Quest. 6. Numerically, read 32*x*
line 4. ditto, read 16*x*
Page 253. line 13. read $c+a-bb$
Page 256. line 4. read $108=ac$

line 7. Numerically, read $\therefore x = \sqrt[2]{1024} = 32$

Page 261. line 2, at the End, read 36

line 3. Quest. 18. Num. read $+ \frac{32x - 2x}{3}$

Page 262. line 5. Literally, read $\frac{3x+4a-4x}{6}$

Page 265. line 6. Lit. read $bca=1050$
line 8. ditto, read $x+bca-ba=bcx$

Page 269. line 5. Num. read $100-y=y$

Page 272. line 5. Lit. read $4=bb$
line 8. ditto, read $ba=\frac{bb}{2}+bbb-y-by$

Page 273. line 7. read $y=\sqrt{144}$
line 6. Lit. read $12=y$

Page 274. line 10. Lit. read $2400=2a-2y$

Page 275. line last, read $bb-cc=5$, and blot out $=bb-cc$ after 25.

Page 285. line 16. read $y=102-3y-x=10$

Page 290. in 2d Step, read $907=a$

Page 297. line 1. Quest. 3. read $50=u$

Page 299. line 3. at the End, read *Price*.

Page 300. line 10. read $d=\frac{u-a}{n-1}=11$
line 13. Geo. Pro. read 16 : 8 : 4

Page 315. line 7. read $x+a=\sqrt[2]{\frac{aa}{4}+bb}$
line 6. Case 3. read $\frac{x-a}{2}=\sqrt[2]{\frac{aa}{4}+bb}$

Page 317. line 3. Quest. 2. Lit. read $\frac{x+a}{2}=\sqrt[2]{\frac{aa}{4}+b}$
line last. read 22.

Page 318. line 3. Quest. 3. Lit. read $\frac{x+b}{2}=\sqrt[2]{x}$

Page 321. line 3. Quest. 6. Lit. read $\frac{175}{x-2}$

Page 323. line 3. Lit. read bx

Page 327. line last, read $xx+\frac{7x}{2}+\frac{49}{16}=$

Page 339. line 3. read $\therefore x-\frac{21}{2}=\sqrt[2]{\frac{81}{4}}$
line 10. Lit. read $xx-ax=-\frac{15b}{8}$

Page 341. line 3. read $\therefore x=\frac{12}{7}+\sqrt[2]{\frac{1156}{41}}=3\frac{1}{3}$
line 2. Lit. read As $\frac{3x-1}{3}:1::b\,\frac{3b}{3x-1}$
line 4. Lit. read Then $\frac{3ax-a+3bx}{3xx-x}=0$

Page 345. line 6. read $dd=\frac{3249}{64}-\frac{143}{4}$ &c.

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